

**Université de Montréal**

# **Firms Performance and CEO Compensation in Canada**

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## **Abstract**

For years researchers have tried to determine if there is a relationship connecting a firm's performance to a Chief Executive Officer's compensation. The bulk of studies have been done in the United States and yielded results that indicated a numerically low, positive correlation between performance and remuneration.

Using a sample of 168 Canadian publicly listed companies for the year 2003 and looking first at a wide array of industry sectors, this paper partially corroborates past research by finding a positive statistical relationships connecting salary to performance. It differentiates itself by finding a high sensitivity level connecting the CEO's salary to a company's performance. The results held true for different compensation structures and for four distinct measures of performance. Furthermore, to try to distinguish if the sensitivity levels between wage and company performance would change when focusing on specific markets, similar tests were applied to a subgroup composed of raw material, industrial product, and public service sectors. While the sensitivity levels between salary and performance were still positive, the coefficients for wage were smaller, which indicated less responsiveness on performance. In either case, it appears that theories regarding incentive contracts are working well to counter the agency problem and that CEO's are in fact operating in the best interest of the shareholders.

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# 1. Introduction

Is there a relationship between a Firm's performance and a Chief Executive Officer's compensation? This question has been in litigation for decades and has recently taken the spotlight with compensation steadily increasing in North America regardless of a firm's poor financial results or condition.

To understand this question, one has to recognize the source of the initial problem. Agency principal theory states that a problem exists when an agent (Chief Executive Officer) has established an agenda, which conflicts with the interests of the principal (Shareholder) (Attaway, 2000). This problem stems in part from the chief executive officers aversion to risk. This behavior induces him to reduce his "personal" risk by engaging in activities that lessen the firm's risks; hence, his actions negatively affect the shareholders wealth.

According to economists, the dominant approach in dealing with this problem is for the board of directors to design a compensation scheme that provides the executive with proper incentives to maximize the shareholders value. Holstrom (1979) has suggested that tying executive compensation to firm's performance will motivate the executive to make more value-maximizing decisions for the stockholders.

For years, the pretense of linking pay to performance has given corporations justification for the size of the compensation packages granted to their CEO's. "In 2000, John Roth of Nortel was awarded 135 million dollars including all the bonuses even though the company stock plummeted from a once high \$124 to \$10."<sup>1</sup> Due to such disparity, stockholders are convinced that no correlation exists between a company's performance and the Chief Executive Officer's salary.

Past studies that grounded their research in agency theory have yielded consistent empirical evidence that have shown a positive statistically significant result, tying pay to performance but with a coefficient small in size, which indicates a marginal impact on wage (Murphy, 1985; Hall and Liebman (1998); Attaway, 2000). Studies traditionally addressed the problem by looking at compensation as a function of performance. The problem was modeled as a simple linear function, where the elasticity sensitivity between wage and performance was analyzed.

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<sup>1</sup> Nortel Network Proxy Circular, May 13, 2001, p.9-10

Most of the research done in this field was focused on the US market; therefore, it would be of great interest to carry out this Master Thesis research in the area of CEO compensation and firm performance, focusing on Canadian publicly traded companies on the Toronto Stock Exchange (TSE). A better understanding of the type of relationship that exists between performance and compensation can bring additional insight to this problem. If there is no meaningful link between pay and performance, it is doubtful that the multi-billions of dollars of assets in public corporations are being managed efficiently.

Using cross sectional data, this study will investigate the effect of CEO cash compensation (i.e., salary + bonus + other short term cash payments), and separately, total compensation (i.e., the sum of all form of salary, cash and long term incentive plans) with different performance measures (i.e., earning per share, return on equity, return on assets, and net profit margin), in a group of 168 Canadian companies listed on the TSE for the period of 2003. In addition, focusing on a specific industry subgroup composed of the raw material, industrial product and public service sector, this paper will test whether or not the sensitivity levels are greater or even statistically significant.

The research begins with section two giving an overview of key concepts discussed in this paper, section three will be a review of past research, section four will present the methodology, and section five will present the empirical results first for the sample as a whole and then for a subgroup of the sample. The research will conclude with a summary of its findings and suggestions for future research.



## **2- Principal-Agent theory**

Agency theory is at the core of any research trying to determine whether a correlation exists between performance and executives pay. The theory defines how to best categorize relationships in which one party (the principal defined as the Shareholder) determines the work, which another party (the agent defined as the Chief Executive Officer) undertakes (Eisenhardt, 1985). Amongst other concepts, the theory argues that under difficult monitoring conditions, such as imperfect information and uncertainty, an agency problem may arise in the form of moral hazard.

### **2.1 Moral Hazard**

Moral Hazard problems are common in labor contracting issues. It is the condition under which the principal cannot be sure if the agent has put forth his best effort. Moral Hazard problems can be present any time two parties come into a risk sharing agreement with one another, and where their privately taken actions affect the profitability of the total outcome. If this situation were to arise, optimal risk sharing is generally excluded since it will not yield the proper incentives for making the correct decision.

Moral hazard problems can take the shape of compensation structure. Since the CEO's compensation will be the same regardless of how much or how little the shareholder will benefit from his work, a fix salary might create a disincentive for taking value maximizing risks and putting forth his best effort. In order to resolve this situation, there needs to be a way to substitute some of the risk sharing where benefits of incentives can be achieved. The action, which is optimal for the agent, will depend on the extent of risk sharing between the principal and the agent (Holstrom, 1979.)

Incentive contracts can yield the proper stimuli for risk sharing. To entice the Chief Executive Officer to perform to the best of his ability, theory on moral hazard problem suggests replacing fixed wages with compensation that is tied to the profits of the company. The provision of ownership rights reduces the incentive for executive's moral hazard since it makes their compensation dependent on their performance (Jensen, 1983).

## 2.2 Incentive Contracts

An incentive contract is such that the remuneration is structured on the basis of the agent meeting specific “incentives” targets in the accomplishment of his contract. The purpose of the incentive contracts is to motivate the agents’ efforts and discourage the agents’ inefficiency and waste. A form of incentive contract is a fixed price contract. It is such that a normal profit is included in the contract and an additional award fee may be rendered for excellent performance.

If a greater percentage of the executive compensation is equity based, it will entice the CEO to take more risk-neutral decisions, which are in the best interest of the principal. In the instance of the contract, the period of performance must be long enough to align the top managers interest with the interest of the principal. Incentive contracts usually encompass a base salary, annual cash incentives, equity-based incentives, and retirement plans. For the 168 companies being observed, 45% of their compensation packages are equity based.

The base salary and annual cash incentive are short-term lump sums issued at the end of the financial year; the latter is dependent of performance criteria and may be paid in the following year. Equity based incentives are referred to as Long-term incentive plans (LTIP). They take the form of Stock option plan, restricted stock plan, phantom stock plan, deferred share units, and stock appreciation rights (SAR).

The Stock Option Plan links compensation to shareholders’ interests because the value of the inducement is directly related to the company’s future stock price. This plans main objective is to give the option holder an interest in maximizing shareholder value over the long term. It enables the firm to attract and retain top managers with experience and ability while rewarding them for long-term performance. Stock option plan seems to be the preferred form of long-term incentive plans.<sup>2</sup>

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<sup>2</sup> 62% of the companies analyzed awarded Stock options units as part of their LTIP.

## 2.3 Option Pricing Theory

Option pricing theory also called Black-Scholes theory, named after Nobel Prize winners Fisher Black and Myron Scholes, proposed that the cost of the option can be known in advance by dynamically hedging the short option while making assumptions on constant volatility and risk neutrality.<sup>3</sup> The risk neutrality assumption is the basis of option-pricing theory and is central to all option-pricing models, including arbitrage pricing models (APT), and Monte Carlo method.

Uncertainty defines dynamic hedging because different moves of the underlier are accompanied by multiple hedging strategies.<sup>4</sup> Since there is a limit to the amount of time you can re-hedge, Black and Scholes took the case as the frequency approaches infinity, which at the limit created independence between the price path of the underlier and dynamic hedging. Since the price now depends on the volatility and assuming it is constant and known in advance, the cost of dynamic hedging a short option becomes certain. With certainty the option can be discounted at the risk free rate to obtain its option price. Since investors can hedge, options can be valued as if the investor was risk-neutral and all assets are appreciated at the risk-free rate.

Option's awarded to executives are long term. Of the 168 companies observed during the course of this research, the average maturity of an option is 8.2 years as opposed to a conventional call option, which matures within 1 year. Merton's (1973) option pricing formulas is a generalization of Black-Scholes model and it can be used to price a stock or stock index paying a known dividend yield.<sup>5</sup> The yield is expressed in terms of an annually compounded rate and is assumed to be constant in this model.

The problem that may arise when using stock options as the pivotal element in an incentive contract is that contrary to an outside investor who can hedge away the risk of his option (i.e., trade the option, or short sell it) a CEO cannot take any of these actions on his stock option. In addition, while outside investors can diversify their assets,

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<sup>3</sup> The original Black-Scholes (1973) formulas can be found in Appendix A

<sup>4</sup> An underlier is a security that is subject to delivery upon exercise of an option contract.

<sup>5</sup> Merton's modified Black-Scholes formula that is used to calculate the value of a European call option can be found in Appendix A.

company executives cannot diversify away some of their risk since a large portion of their assets (i.e., salary taking the form of stock options) is invested in their company.

### 3 Past Literatures

Researchers in the past have established that there is a correlation between a top executive salary and a firm's performance. While the strength of the relationship is usually numerically small, it is nonetheless positive and statistically significant. The literature defines performance as a determinant of compensation and looks at other possible factors that can affect the CEO's wage. Countless articles focus on the United States due to the size of the market and the availability of data. A few of these articles were collected and summarized.

#### 3.1 Article Review

(i) Kevin J. Murphy's article, "Corporate performance and managerial remuneration, an empirical analysis", *Journal of Accounting and Economics*, issue 7, 1985, analyzes the relationship between compensation and performance when accounting for different types of compensation package and performance indicator.

Murphy uses panel data for 73 of the largest US manufacturing firms over the period of 1964-1981. The top executives in his sample have maintained their position as CEO for a minimum of five consecutive years. The model defines compensation as endogenous, and it is a function of performance.

$$Comp_{it} = a_i + b_i Perform_{it} + e_{it}$$

The empirical analysis focuses on six components of remuneration: Salary, Bonus, Salary & Bonus, Deferred Compensation, ex-ante value of stock options, and total compensation. Call options are valued using Merton's modified Black-Scholes formula.

Since shareholders are considered to be the principal in agency theory, corporate performance is not measured in terms of accounting profits, it is based on the rate of

return realized by shareholders ( $R_t$ ).<sup>6</sup> Murphy estimates that performance depends in part on past and current levels; hence, he creates a performance index to represent the cumulative stock market performance of each sample firm:

$$S_t = S_{t-1}(1 + R_t)$$

Murphy runs several sets of regressions by OLS. His first time series results of total compensation on performance yielded a pronounced positive effect. The estimated coefficients also suggest that the individual components of remuneration are sensitive to the shareholder's realized rate of return. "A firm realizing a 10% return will increase the total remuneration paid to its executive by 2.1%." Murphy attempted to compare his finding to past cross-sectional research by averaging the compensation and firm variables over time for each executive. The regression yielded a negative, statistically insignificant, coefficient for performance. "A firm realizing a 10% return will pay its executive 1.1% less than a firm with zero returns."

Since shareholder's return is an imperfect proxy for managerial effort and the disparity between cross sectional data and time series was so pronounced, Murphy added the variable *sales* as an additional measure for performance. He re-ran two sets of regressions for both time-series and cross-sectional data, and he observed that in both cases the total compensation regression indicated a positive relationship between wage and performance. On average, a firm with a 10% return will increase total remuneration paid to executive by 1% in the case of cross sectional data and 1.6% using time series data.

His results indicate that there is a positive relationship between remuneration and firm's performance that is statistically significant. In addition, this correlation appears slightly numerically stronger when using a time series process.

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<sup>6</sup>  $R_t = \frac{P_t + DPS_t}{P_{t-1}} - 1$  , Where P and DPS are the closing stock price and dividends-per-share paid in

fiscal year t, adjusted for stock dividends and splits.

(ii) Morris C. Attaway's article, "A Study of the relationship between company performance and CEO compensation", *American Business Review*, Jan 2000, tries to establish if the correlation between pay and performance is more significant when focusing on a specific industry sector (i.e., the computer and electronics industry).

To determine the type of relationship that connects pay to performance, he uses panel data from 1992-1996 on 42 firms in the computer electronics sector. In order for firms to be included in his sample, all data had to be available for the period observed, the company had to be managed by the same CEO, and the executive had to be listed as one of corporate America's most powerful people.

Attaway uses a linear model, writing compensation as a function of return on equity (ROE), executive age, job tenure, stock ownership and education. Compensation is strictly based on salary and cash bonus because he considers it an acceptable substitute for more comprehensive measures (i.e., pension benefit, deferred pay, stock options, stock bonus, and profit sharing). Most of the variables used are self-explanatory except for education, which is grouped as no college, bachelor degree, masters degree, and above masters. For the performance measure, he chose ROE as the proxy variable.

The null hypothesis of his model: "There is a negative relationship or no relationship between pay and ROE". The hypotheses were tested using Pearson Product Moment correlation and linear square regression analysis. The findings of his descriptive statistics are that all variables were statistically significant at 1% except for education, which meant that the null hypothesis was rejected. A 1% increase in performance would increase the executive's wage by 0.005%. While the coefficient of ROE is positive and significant, the magnitude was found to be very small, which indicates very low sensitivity levels in the computer and electronics sector.

Being aware of the limitations of his research, Pearson suggests looking at a larger sample that will encompass both small and large firms, to include other comprehensive measures when defining wage, and to target other industry sectors to see if this phenomena is related to an industry effect.

(iii) Brian J. Hall and Jeffrey B. Liebman's in the article, "Are CEO's really paid like bureaucrats," *Quarterly Journal of Economics*, Vol. 113, August 1998, examines the relationship between CEO compensation and firm performance, by measuring how the value of a CEO stock and stock option changes when a firm's stock market value changes.

They used a panel data set from 1980-1994 for CEO's of the largest publicly traded American companies. Firms included in his study were listed at least once in Forbes 500 lists during the period analyzed. Although Hall and Liebman used relatively the same construct as Attaway (2000), they used them differently. They look at a linear relationship between compensation as a function of performance and CEO determinants. Compensation was defined as salary & bonus, stock option, restricted stock, other compensation, change in the value of stock holding and change in the value of stock option holding. The proxy for performance is taken as the stock price and stock return. The other exogenous variables are age, tenure, and stock ownership. Merton's modified Black-Scholes formula was used in order to value stock option grants and holdings.

Since Hall and Liebman's data contained detailed information on CEO stock and stock option holdings, it enabled them to calculate the change of a CEO's wealth that is a direct product of a change in his respective firm's market value.

They use ordinary least square analysis to determine how sensitive executive compensation is to company performance. They break their analysis down into a few sections. First, they compare only salary and bonus to rate of return by running regressions with robust standard errors and find that although there is a positive relationship-tying wage to performance, the magnitude is relatively small. Second, the stock options and stock holding information is regressed with stock price. Changes in CEO wealth are now highly responsive to firms' performance. "A \$1000 increase in firm value increases CEO wealth by about \$25 at the mean and \$5.29 at the median." These results corroborate the research of Murphy (1985); however, Hall and Liebman note that this responsiveness is mainly driven by changes in the value of the stock and stock options.

### 3.2 Weakness of past research

After spending a fair amount of time researching this topic, I have uncovered what I consider to be several errors that may have affected results in past studies.

First, researchers never properly state the question they are trying to answer. While it seems they are trying to determine if a fluctuation in wage has an impact on a firm's performance, they build a wage equation and test for possible determinants. They are trying to determine if variations in performance will be followed by an increase or decrease in salary. While the results are interesting in assessing which variable might define wage, it does not answer what seems to be the underlying question of this problem (i.e., "Does an increase in salary, increase or decrease the performance level of a company?")

Second, upon building their linear model, several studies have consistently listed performance as an exogenous variable. This is somewhat confusing since performance is theoretically an endogenous variable, and while the choice of taking a proxy for performance is not contested, the lack of any assumptions to support such claims, or the indication that any type of endogeneity test were run, is quite surprising due to the quality of some papers. Endogeneity in a model signifies inconsistent biased estimator; hence, it is probable that most of the results currently found in the literature are erroneous and do not correctly answer their question of interest.

Finally, Attaway is one of the many who has defined compensation as a short-term cash incentive.<sup>7</sup> Although it is true that the a cash bonus is often defined on a performance criteria, the bulk of the incentive comes in the form of long term incentive plans; hence, not including this information when accounting for wage will yield weaker results that do not correctly define the relationship between CEO salary and firms performance.<sup>8</sup> While most researchers support their decision based on comparability with past studies, it does not justify excluding this information considering they ground their paper on agency theory, which proposes incentive scheme as a way to solidify the correlation between performance and salary.

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<sup>7</sup> Here are a few other researchers: Murthy and Salter (1975); Veliyath and Bishop (1995); Akhigbe, Madura, and Tucker (1995) who have defined remuneration on a short term cash scale.

<sup>8</sup> See section 4.3 for proper definition.



## 4 Methodology

### 4.1 Model

In light of past empirical research, I intend to hypothesis the following:

***Ho(a): Compensation is not statistically significant***

Equation (1) describes the model used to test the relationship between performance measures and compensation:

$$(1) \quad \begin{aligned} Performance = & B_0 + B_1 \log(compensation) + B_2 Date\_of\_formation \\ & + \delta_k Industry\_sector + u \end{aligned}$$

for k=1,2,3,4

Ordinary least square regression will be used to test this model. If I reject the null hypothesis, I establish that there is a link between performance and pay.

An endogeneity problem might occur with respect to compensation. Theoretically wage is an endogenous variable; hence, any attempt to regress an endogenous on an endogenous will yield erroneous results in the form of bias and inconsistent estimators. To correct this problem, I use instrumental variables. Equation (2) describes the model used to define the instrumented variable:

$$(2) \quad \begin{aligned} \log(compensation) = & B_0 + \delta_k industry\_sectors + B_2 date\_of\_formation \\ & + B_3 Age + B_4 tenure + B_5 tenure^2 + B_6 (\%outside\_directors) + B_7 (size\_board) \\ & + \alpha_j Management\_type + \lambda_j Stock\_Exchange + \gamma_m education + B_{10} Size + e \end{aligned}$$

m=1,2,3, j=1,2, and k=1,2,3, 4

To chose a proper instrument one needs to follow two properties: The variable needs to be uncorrelated with the error of the structural model. This is verified using an “Over identifying restriction test”. The second is that the instrumented variables are correlated with the instrumental and are all jointly significant. An F statistic is used to test if the instrumental variables are jointly significant. The size of the R-square from equation (2) will determine whether the instrumentals are weak. The instrumental variables were chosen based on their wide usage as determinants in traditional wage equations.<sup>9</sup>

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<sup>9</sup> Further detail of each instrumental is given in section 4.3

Testing for endogeneity, leads to the following hypothesis:

***Ho(b): Compensation is exogenous***

Equation (3) describes the model used to test for endogeneity once the fitted residual values from equation (2) are gathered:

$$(3) \quad \text{Performance} = B_0 + B_1 \log(\text{compensation}) + B_2 \text{date\_of\_formation} + \delta_k \text{Industry\_sector} + \alpha_1 \text{residual\_hat} + u$$

k = 1, 2, 3, 4

If we reject the null hypothesis, then compensation is endogenous. If salary is endogenous, I proceed to run a two stage least square (2SLS) regression. This leads me back to the initial hypothesis:

***Ho(a): Compensation is not statistically significant***

Equation (4) describes the form the regression will take when correcting for endogeneity:

$$(4) \quad \text{Performance} = B_0 + B_1 \log(\text{Compensation})^* + B_2 \text{date\_of\_formation} + \delta_k \text{Industry\_sector} + u$$

k = 1, 2, 3, 4

I will also be looking at a subgroup of the entire sample to establish if the sensitivity level between pay and performance becomes weaker, stronger or remains unchanged. In addition, the hypothesis and model specified in section 4.1 will remain unchanged.

## 4.2 Data Source

The sample consists of 168 random Canadian firms listed in the *Financial Post* top 500 companies issue. Of the original 342 firms, close to half had to be removed due to incomplete proxy information or because historical stock price information was unavailable.<sup>10</sup>

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<sup>10</sup> List of all company observed can be found in Appendix B

Cross-sectional data was favored over panel data due to data availability<sup>11</sup>. My research director and myself decided that the additional inference gained from panel data would have been minimal considering the period observed is after the implosion of the stock market, caused by the “dot com” companies and other company scandals such as Enron, Worldcom, and Nortel. In addition, Hall and Liebman’s results showed a very small difference in coefficients magnitude when favoring time series over cross sectional data.

Information for each of the companies CEO’s selected for the sample was gathered from the Financial Post database, publicly available filing with SEDAR (i.e., proxy statement, annual report), and direct communication with companies investor relation representatives. The industrial makeup of the sample of 168 firms is 28% for consumer goods and pharmaceutical industry, 42% for the raw material, industrial product, and public service sector, 18% for telecommunication, information technology, and media related sector, and 12% for financial and real estate sector.

Additional information for 2003 was collected: Salary, bonus, restricted stocks, phantom stocks, deferred stocks, number of options granted and their exercise price, number and identity of outside blockholders, number of members sitting on the board of directors, date of formation of the company, size of company, age and tenure of the CEO.

### **4.3 Chosen Variables**

*Performance measure:* I intend to use four-performance measures. Earnings per share, return on equity, return on asset, and net profit margin. I chose accounting performance measure because they are less affected by unpredictable market environment, and it makes them more informative regarding managerial contribution. The use of multiple measures of performance is to confirm whether the results obtained are robust and remain invariant.

Earnings per shares (EPS) are probably one of the most popular measures used by an investor when looking at investment choice.<sup>12</sup> It is a performance measure with a

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<sup>11</sup> Specific wage labor data is not readily available as it is in the US. Also, there is a requirement that an executive must occupy the same position during the period observe, which would have further diminished the amount of companies being observed.

<sup>12</sup> EPS: Net Income/ Total number of (o/s) shares.

straightforward interpretation since it is the portion of profit allocated to each outstanding share of common stock.

Return on equity (ROE) is equal to the return from investments relative to the equity invested.<sup>13</sup> It is widely viewed as a measure of a corporation's profitability. It reflects how much the company has earned on the funds invested by the shareholders, and it is an important ratio when interpreting a company's performance.

Return on Assets (ROA) measures the return to shareholders relative to the total assets of the firm.<sup>14</sup> It tells you what earnings were generated from invested capital. It is a profitability measure, and it indicates how efficient the company is in generating profits with the assets it holds.

Net-profit margin is an efficiency measure that gives information on how well a company manages its cost.<sup>15</sup> It is a good way to compare companies in the same industries to see which industry is managed proficiently. I chose it because it looks at net profit instead of net earnings.

*Compensation structure:* I use two forms of compensation measure: The first is the log of cash compensation taken strictly as salary + bonus + other forms of cash payments. The second is the log of total compensation, which is the sum of salary, bonus, other type of cash payments, restricted stock units, phantom stock, deferred stock units, stock options granted, and stock appreciation right. I did not include data for retirement plan or severance pay packages because company proxy information is incomplete.

The bonus is an annual cash incentive. It is often a lump sum that is paid at the end of the current or following fiscal year. The bonus is usually based on performance and is often tied to certain performance criteria such as Economic Value Added (EVA).

*Other forms of cash payment* are all the type of short-term cash incentives given to an executive. They range from car payments, to additional cash remuneration.

Restricted Stock Units (RSU) is insider holdings that are under some type of sales restriction. They are shares given to the CEO, or sold to the CEO at a discounted price.

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<sup>13</sup> ROE: Net income / Shareholders equity

<sup>14</sup> ROA: Net income / Total Assets

<sup>15</sup> NPM: Net profit/ Net income

The restrictions on the stock may imply that the stocks cannot be sold within a certain time horizon, or they cannot be sold until certain performance criteria have been met.

Phantom Stocks is not a physical stock, but a pretend stock. Even though it is not real, phantom stock follow the price movement of the company's actual stock, paying any resulting dividends.

Deferred Share Units (DSU) is similar to the restricted shares; however, they would typically be exchanged at retirement or upon termination of employment. They are awarded to top executives only. Usually, deferred shares vest in full at the end of five years, contingent upon the executive remaining in the employment of the issuer over the vesting period.

Stock Appreciation Right (SAR) is similar in concept to phantom stock except that it provides a right to collect appreciation on stock for a predetermined number of stocks, for a specified period of time.

European Call Option is an agreement that gives an investor the right (but not the obligation) to buy a stock at a specified price within a specific time period. During the course of this paper, CEO's who were awarded American Call Options were excluded.<sup>16</sup>

*Other Exogenous variable:*

Industry sectors are listed as dummy variables with the base group being the financial/real estate sector. They take the form:

$$D1: \begin{cases} 1 & \text{If company deals in consumer type goods, pharmaceutical} \\ 0 & \text{If otherwise} \end{cases}$$

$$D2: \begin{cases} 1 & \text{If company deals in raw materials, industrial products or public service} \\ 0 & \text{If otherwise} \end{cases}$$

$$D3: \begin{cases} 1 & \text{If company deals in telecom, IT, media or entertainment} \\ 0 & \text{If otherwise} \end{cases}$$

$$D4: \begin{cases} 1 & \text{If company deals in financial sector or real estate} \\ 0 & \text{If otherwise} \end{cases}$$

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<sup>16</sup> The choice to exclude this information is based on the nature of the American Option. Since you can exercise the option at any time up to the expiration date, it makes it too complex to value.

The variable *management type* is listed as a dummy variable. If the owner, individual investors, pension funds, mutual funds, or investment firms hold a minimum of 10% of the outstanding shares, then I say, “the company is run by the owner”.<sup>17</sup> If the company does not appear to have any block stockholders, then I say, “The manager runs the company.” The base group is owner run.<sup>18</sup>

$$\text{RUN1: } \begin{cases} 1 & \text{If Run by owner} \\ 0 & \text{If otherwise} \end{cases}$$

$$\text{RUN2: } \begin{cases} 1 & \text{If Run by manager} \\ 0 & \text{If otherwise} \end{cases}$$

Percentage of outside directors is the percentage of the board of directors who is not a top executive, a retired executive, nor a former executive of the company. Education was defined as a dummy variable because of the nature of the data.<sup>19</sup> The base group is educated up to a bachelor degree (Educ1).

$$\text{Educ1: } \begin{cases} 1 & \text{Education up to and including a Bachelor degree} \\ 0 & \text{If otherwise} \end{cases}$$

$$\text{Educ2: } \begin{cases} 1 & \text{Educated 1 - 3 years post bachelor degree} \\ 0 & \text{If otherwise} \end{cases}$$

$$\text{Educ3: } \begin{cases} 1 & \text{Educated + 4 years post bachelor degree} \\ 0 & \text{If otherwise} \end{cases}$$

Tenure is the number of years the chief executive officer has maintained his current position. I used the logarithm of total revenue (or total sales) as a proxy for size of the company, and the date of formation is the date at which the company was first incorporated.

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<sup>17</sup> Proxy statements indicate principal shareholders for any individual or group that owns 10% of common stock.

<sup>18</sup> 55% of the companies in the sample seem to be “run by owner”.

<sup>19</sup> Educated 1-3 years post bachelor (ex: CA, CFA, MBA, M.Sc). Educated +4 years post bachelor degree (ex: P.hd, double MBA, double M.Sc). Specific information pertaining to time spent to acquire a degree or an accreditation is not available to the public.

Finally, Stock exchange is listed as a dummy variable. The base group is trading on one exchange (SE1).

$$\text{SE1: } \begin{cases} 1 & \text{Trading only on one Stock exchange} \\ 0 & \text{If otherwise} \end{cases}$$

$$\text{SE2: } \begin{cases} 1 & \text{Trading on two or more Stock exchanges} \\ 0 & \text{If otherwise} \end{cases}$$

## 5 Empirical Results

Sections 5 will be separated in two sub-sections. 5.1 will test the hypothesis stated in 4.1 on the sample as a whole and section 5.2 will test the same hypotheses but focusing strictly on a subgroup of the sample (i.e., D2: raw material, industrial, and public service sector).

### 5.1.1 Descriptive statistics

The final sample consists of 168 firms for the year 2003. The mean ROE for 2003 is 10.18%, the mean ROA is 5.94%, the mean EPS is \$1.26, and the mean net profit margin is 6.41%. On average the companies are healthy, profitable, and appear to be managed efficiently. The mean compensation for the CEO (salary + bonus + other cash payment) is \$1,237,321, the mean LTIP is \$1,073,874, and the mean of total compensation is \$2,311,195.

**Table 1**  
**Frequency table for the Binary variables (n=168)**

	Number	Percent
<b>Level of Education</b>		
Up to Bachelor	82	49%
1-3 Year post Bachelor	67	39%
4 Year post Bachelor	19	12%
<b>Stock Exchange</b>		
Trading on one	109	65%
Trading on multiple	59	35%
<b>Ownership type</b>		
Owner run	101	60%
Manager Run	67	40%
<b>Industry Sectors</b>		
D1	48	28%
D2	70	42%
D3	30	18%
D4	20	12%



The average total salary is quite substantial and passed the 2 million dollar level, yet since the firms display positive profitability measures and have sales ranging in the billions, it does not seem excessive. CEO's in the sample are on average 54 years old, with 9.2 years of tenure, and above 50% of them have a post bachelor degree education. The firms in the sample are all considered large with average sales above three billion dollars annually; they have been incorporated for an average of 33 years. The remaining descriptive statistics (min, max, and standard deviations) are disclosed in tables 1 for binary variables and table 2 for other control variables.

**Table 2**  
**Summary of selected statistics (n=168)**

<b>CEO Variables</b>	<b>Mean</b>	<b>Std Dev</b>	<b>Min</b>	<b>Max</b>
Salary + Bonus + Other (\$000's)	1,237.32	1,132.72	111.8	6,781.21
LTIP (\$000's)	1,073.87	1,747.58	0	11,198.75
Total compensation (\$000's)	2,311.20	2,458.41	111.8	12,844.54
Age	53.982	8.525	36	89
Tenure	9.263	10.18	0	51
% Outside	73.419	15.822	13.33	100
Sitting	10.095	3.325	4	20
Size (\$000's)	3,274,064	5,316,311	1,956	29,000,000
Date of Formation	33.601	39.407	1	333
<b>Firm Variables</b>				
EPS	1.258	1.74	-6.21	8.09
ROE	10.181	14.52	-51.62	61.41
ROA	5.943	7.366	-33.9	33.79
NPM	6.418	13.663	-88.73	65.1

As can be expected, wide variations exist for some variables. Figure 1 shows the distribution of total pay including LTIP's for 2003. It appears that the bulk of salaries are concentrated around the hundred thousand dollar point rather than the tens of millions of dollars level. This is an interesting observation since public perception assumes the opposite. There are similar wide variations for other explanatory variables. Unfortunately, these variations only tell us that there are significant differences between

the values and do not offer a better interpretation. The information that does single itself out is that long-term incentive plans account for 50% of total salary. It seems that companies judge the current methods of incentives as acceptable. They are convinced that these methods are aligning the objectives of the executive with those of the company.

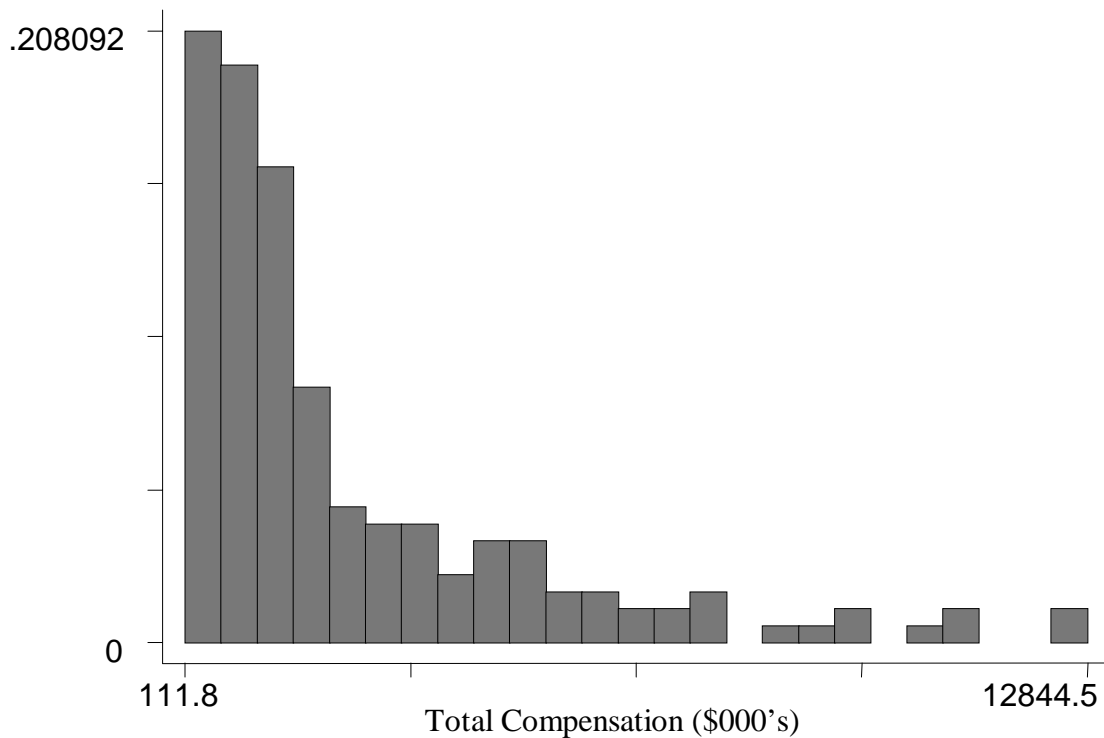


Figure 1, Distribution of Total Compensation

104 firms issued stock options to their Chief Executive Officers as part of their LTIP. The average *Call option* awarded to a CEO has a value of \$7.23. Executives are awarded a mean of 177,589 units for an average market value of \$1,226,357. These options have an average maturity of 8.4 years and a mean annual volatility of 32%.<sup>20</sup> The maximum value of volatility for a stock was 163%. While it appears very high, it was expected since I analyzed a period of 24 months to estimate stock volatility.

There is a potential problem when valuing an option using Merton's formula. This problem is centered on the constant volatility assumptions used to support his model.

<sup>20</sup>  $\sigma = s \cdot \sqrt{252}$  The volatility is equal to the daily standard deviation of the stock times the squared root of trading days in a year.

Assuming a constant volatility when looking at a period ranging from 4 to 11 years is not accurate because a stock will not maintain a set price level or remain stable for an indefinite amount of time. While I acknowledge that the options I valued have a potential valuation error, Merton's model is still taken as an industry standard and there is no other valid model available at this present time to rectify this problem. The remaining descriptive statistics (min, max, and standard deviations) for the other variables used in Merton's model are disclosed in tables 3.

**Table 3**  
**Options summary statistics (n=104)**

	Mean	Std. Dev	Min	Max
Market Value	23.220	19.156	0.640	108.783
Strike Price	23.202	19.180	0.640	108.783
Maturity	8.385	1.987	4.000	11.000
Dividend yield	0.022	0.031	0.000	0.203
Risk free rate	0.045	0.003	0.035	0.053
Volatility	0.320	0.209	0.137	1.630
Number of options (000's)	177.589	207.507	10.000	1,320.000
Call option	7.236	6.468	0.021	43.324
Value of option (000's)	1,226.357	1,756.719	0.997	11,200.000

Looking at the correlation matrix of compensation and other control variables in table 4, I see that the size of the company and executive wage are correlated at close to 70%, which is high and ties perfectly with Schaefer's (1998) research that indicate size as a strong determinant for CEO's salary. There is a significant correlation between wage and number of directors sitting on board, which corroborates Core, Holthausen, and Larcker's (1998) findings of the impact the board composition has on remuneration being issued. There is also a positive correlation between a firm's size and the number of directors sitting on the board. While some variables are strongly correlated, there seems to be no sign of multicollinearity because none display correlation levels close to unity.<sup>21</sup>

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<sup>21</sup> Whether a strong linear relationship translates into a  $\text{var}(\hat{\beta}_j)$  that is too large to be useful, it depends on the size of  $\sigma^2$  and  $SST_j$  and cannot be defined solely on a high correlation level.

**Table 4**  
**Correlation Matrix (Compensation, other control variables)**

	lsalbon	ltotcomp	age	tenure	outside	sitting	size	form
<b>Lsalbon</b>	1							
<b>ltotcomp</b>	0.8634	1						
<b>Age</b>	0.0414	0.0034	1					
<b>tenure</b>	-0.0248	-0.1151	<b>0.4304</b>	1				
<b>outside</b>	0.1863	0.2234	-0.0234	-0.2001	1			
<b>sitting</b>	<b>0.5438</b>	<b>0.535</b>	0.0374	-0.0229	0.1863	1		
<b>size</b>	<b>0.6627</b>	<b>0.7155</b>	-0.0509	-0.089	0.146	<b>0.6354</b>	1	
<b>form</b>	0.2654	0.2218	0.0882	-0.0264	-0.0632	0.3511	0.3028	1

### 5.1.2 Results

Ordinary least square regression was used to test the first hypothesis of the model. The results of the regression are displayed in Table 5. I begin by analyzing model (1). Cash compensation and total compensation are significant below 1%; therefore, I reject the null hypothesis in both cases. There is a positive relationship between pay and performance; hence, increases in pay, will increase performance. Since this is a level-log model, increasing cash compensation by 1% will increase EPS by only \$0.0074. At first glance, the coefficient looks small. To get a better estimate of the actual impact on performance, I use the data from the sample average company. With a salary at \$1,237,321 and a firms EPS at \$1.258, an increase of 1% on wage will increase net earning by 0.6%. In the case of total compensation, the coefficient has diminished by close to 30% in size. Increasing total compensation by 1% will increase EPS by \$0.0055. A 1% increase on the average executive salary yields a 0.4% increase on the average company's net income. This corroborates past researchers findings that there is a positive correlation between pay and performance. The impact of pay on performance is not marginal as one expects when looking at the size of the coefficient since a 0.4% increase on performance is not negligible<sup>22</sup>. While it does not represent the ideal 1 to 1 ratio (i.e.,

<sup>22</sup> EPS increases to 1.2654. The average net income of a company is \$229,786,570. Wage goes up by \$12,373 and increase net income by \$919,146. While it is true that average earnings are in the hundred of millions, you have to keep in mind that this increase is solely guided by salary; hence, the greater the percentage increase in salary, the greater the increase in earnings.

1% increase in wage = 1% increase in performance), it is still a good first indication of the efficiency of incentive contracts.

**Table 5**  
**Cross Sectional Regression**

	Model (1) <b>EPS</b>	Model (2) <b>ROE</b>	Model (3) <b>ROA</b>	Model (4) <b>NPM</b>
Intercept	-8.684 (2.266)	-51.018 (20.145)	-23.699 (10.016)	-44.880 (18.608)
Log cash compensation	<b>0.740</b> (0.162)	<b>4.414</b> (1.442)	<b>1.942</b> (0.717)	<b>3.975</b> (1.332)
Form	<b>0.004</b> (0.003)	-0.017 (0.030)	<b>-0.026</b> (0.015)	<b>-0.038</b> (0.027)
D1	-0.249 (0.431)	4.387 (3.833)	5.857 (1.906)	-2.888 (3.540)
D2	-0.231 (0.413)	0.510 (3.668)	4.558 (1.824)	0.658 (3.388)
D3	-0.959 (0.471)	-1.139 (4.184)	1.926 (2.080)	-7.548 (3.865)
Observations	168	168	168	168
<b>R-squared</b>	0.180	0.069	0.106	0.103
Intercept	-6.354 (1.843)	-37.260 (16.338)	-16.258 (8.141)	-37.635 (14.991)
Log Total compensation	<b>0.554</b> (0.127)	<b>3.314</b> (1.126)	<b>1.360</b> (0.561)	<b>3.347</b> (1.033)
Form	<b>0.005</b> (0.003)	-0.012 (0.029)	<b>-0.024</b> (0.015)	<b>-0.036</b> (0.027)
D1	-0.307 (0.432)	4.048 (3.829)	5.670 (1.908)	-3.053 (3.513)
D2	-0.310 (0.413)	0.044 (3.665)	4.337 (1.826)	0.298 (3.363)
D3	-1.005 (0.472)	-1.412 (4.188)	1.788 (2.087)	-7.729 (3.843)
Observations	168	168	168	168
<b>R-squared</b>	0.172	0.065	0.098	0.111

When looking at both compensation structures, the variable *form* is statistically significant at 20%. If you increase the date of formation by 1 year, you increase

performance by 0.005\$.<sup>23</sup> The size of the coefficient is indicative of potential economies of scale. The industry sectors dummies are all statistically insignificant except for D3. Companies in subgroup D3 have, at the base, lower earnings per share.<sup>24</sup>

Regardless of the form of remuneration structure, the interpretation will vary if one were to look at a very high EPS or a very small one. In the initial case, the effect will become marginal whereas in the later the effect will become substantial.<sup>25</sup> To get a clearer picture on the size of salary variation on performance, I use three other performance measures (i.e., ROE, ROA, NPM). With a log-log model, the relationship is defined as the elasticity of firm's performance with respect to a CEO's compensation.

Model (2) uses ROE as the performance measure. Using either cash compensation or total compensation, I reject the null hypothesis  $H_0(a)$  below 1%. The relationship is positive. A 1% increase in cash compensation will raise return on equity by 4.44%, which means a company's net income would also increase by 4.44%. In the case of total compensation and holding other factors fixed, a 1% increase on total wage will raise ROE by 3.31%, which represents a 3.31% increase on net earnings.<sup>26</sup> The results appear to be strong enough to dictate the performance a company can expect if it were to increase a CEO's salary. In addition, none of the other exogenous variables used in the model appear to be statistically significant.

Model (3) replicates the regression using ROA as the performance measure. The coefficient for cash and total compensation are positive and significant below 1%; hence, I reject the null hypothesis  $H_0(a)$  in both cases. When cash compensation increases by 1%, ROA increases by 1.94%. Holding other factors fixed, this increases a company's net income by 1.94%. When total compensation increases by 1%, ROA increases by 1.36%, which again implies a 1.36% increase on net earnings.<sup>27</sup> As with ROE, the impacts of wage fluctuations are extremely strong and go above a 1 to 1 ratio. This implies that regardless of other factors, a salary increase alone can be expected to substantially increase a company's earnings. The variable *form* is significant at 10%, but it now

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<sup>23</sup> Looking once more at the samples average company, this represents an increase of 0.4% on net income.

<sup>24</sup> The average company in that subgroup have an EPS that is 0.8% smaller than other sectors (i.e., 1.247 instead of 1.258).

<sup>25</sup> EPS can be greater if the number of outstanding common shares is small or if the company's net earning is very high.

<sup>26</sup> Assuming a company has net earnings at \$300,000,000, this represents a \$9,930,000 increase.

<sup>27</sup> Once more assuming the same level of net earnings, this represents an increase of \$4,080,000.

displays a negative relation with performance. When looking at both remuneration structures, adding 1-year to the existence of a company will decrease its ROA by 2%, which is counter intuitive. More time spent in an industry should give a company additional insight, improve their efficiency level, and not hinder their performance level. The industry sector dummies are all statistically significant at low levels, except for subgroup D3 who becomes significant at levels of 30% and above. All sectors exhibit a positive relation with ROA, and depending on the industry, the performance intercept varies between 1 to 5%.

Finally, Model (4) replicates the regression but with NPM as the performance measure. While it is not used traditionally as a performance measure, I found merit in using it because it gives a direct estimate on net profits variations. The coefficient for cash and total compensation are positive and significant for values below 1%; hence, I reject the null hypothesis  $H_0(a)$  in either case. When cash compensation increases by 1%, NPM increases by 3.98%, which means that a company's net profit would increase by 3.98%. In the case of total compensation, holding other factor fixed, a 1% increase in wage, will increase NPM by 3.34%, which again indicates a 3.34% increase for a company's net profit.<sup>28</sup> As with ROA, the variable *form* exhibits a negative relation with performance and is only statistically significant at 18%. None of the industry sector dummies are significant aside from D3, which is significant at 5% for both compensation structures. Subgroup D3 net profit margin intercept is lower by 2%.

### 5.1.3 Endogeneity

To test the second hypothesis of endogeneity, I start by running a regression with robust standard error on equation (2) to verify if the instrumental variables are correlated with different forms of wage and if they are jointly significant. Table 6 summarizes the results. *D1*, *D2*, *D3*, and *Form* are the exogenous variables from the structural model, and the other variables listed are the instrumental variables.

Since total compensation holds more interest in the context of my paper, I will give a detail analyzes of its determinants. *SE2*, *Run2*, and *Size* are significant at 1%, *Edu3* is significant at 10%, and *Sitting* is significant at 25%. They all exhibit a positive relation.

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<sup>28</sup> Assuming a company yields net profit of \$50,000,000, this represents a \$1,670,000 increase.

When *Sitting* increases by 1%, wage goes up by 0.24%; hence, the impact on salary is minimal. When *Size* increases by 1%, wage goes up by 0.36%. The magnitude is weaker than I first anticipated and does not appear to coincide with past American findings indicating a strong sensitivity between a company size and executives wage.

**Table 6**

**Regression with Robust Standard Errors**

	Model (5) <b>Log(Cash Compensation)</b>	Model (6) <b>Log(Total Compensation)</b>
Intercept	7.380 (0.887)	5.896 (0.997)
Form	0.001 (0.001)	0.001 (0.001)
D1	-0.075 (0.169)	0.101 (0.190)
D2	-0.078 (0.163)	0.036 (0.184)
D3	-0.109 (0.181)	-0.010 (0.204)
Age	0.002 (0.006)	0.000 (0.007)
Tenure	0.009 (0.012)	-0.002 (0.014)
Tenure2	0.000 (0.000)	0.000 (0.000)
Educ2	0.011 (0.103)	0.106 (0.116)
Educ3	<b>0.251</b> (0.157)	<b>0.318</b> (0.177)
Outside	<b>0.004</b> (0.003)	0.002 (0.004)
Sitting	<b>0.036</b> (0.020)	<b>0.027</b> (0.022)
SE2	<b>0.095</b> (0.113)	<b>0.379</b> (0.127)
RUN2	0.012 (0.104)	<b>0.288</b> (0.117)
Size	<b>0.264</b> (0.040)	<b>0.358</b> (0.046)
Observations	168	168
R-square	<b>0.4907</b>	<b>0.5987</b>



If the company is trading on more than one stock exchange, the CEO will earn 46.6% more on his salary.<sup>29</sup>

If the executive manages the company, he will earn 33.3% more on his salary. The result is surprising, but it is a sign of evident disparity in salary schemes when a CEO is free to run the company without anyone of influence (i.e., blockholders or owners) to curb some of his power.

When looking at both models, the first thing that becomes obvious is the strength of the instrumental variables. For model (5), I have an R-square of 50%, and I reject the null hypothesis of *not jointly significant*, with an F-Stat of 12.07. For model (6), I obtain an R-square of 60%, and I also reject the null hypothesis of *not jointly significant* with an F-stat of 20.39. Both F-statistics are high, and while some of these instrumental variables are not individually significant, they are jointly significant.

With model (5) and (6) exhibiting strong instrumental variables that are jointly significant, I proceed to collect the residual for both models and run OLS regressions on equation (3). Table 7 summarizes the results.

Results from Table 7 indicate that for performance as measured by ROE and ROA, I fail to reject the null hypothesis that wage, whether it is taken as cash compensation or total compensation, is an exogenous variable. Therefore, results estimated by OLS are robust and hold. On the other hand, using both forms of compensation, the results for EPS and NPM show a t-statistics that is significant for *residual*; consequently, I reject the null hypothesis  $H_0(b)$  of wage being exogenous.

In the case of EPS, the *residual* is significant at 10% for both salary structures. For NPM, the variable is only significant for total compensation at 7%. With the presence of an endogenous, the results estimated by OLS for EPS and NPM become biased and inconsistent. I proceed to run a two stage least square on equation (4).

The coefficients estimated are the same as the ones listed in Table 7. The only thing that changes is the R-square, but it is inconsequential when estimated by 2SLS because it has no natural interpretation.

The first thing that becomes obvious is the size of the coefficients. Cash compensation and total compensation are significant at less than 1%. A 1% increase in

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<sup>29</sup> To measure the change in y:  $\% \Delta y = 100 \cdot [\exp(\beta_j) - 1]$

cash compensation increases EPS by 0.012\$. The size of the coefficient increased and is now indicative of a 0.9% increase of the average company net earnings.

**Table 7**  
**OLS Regression with residuals**

	Model (7) <b>EPS</b>	Model (8) <b>ROE</b>	Model (9) <b>ROA</b>	Model (10) <b>NPM</b>
Intercept	-14.815 (3.331)	-52.792 (30.172)	-22.207 (15.000)	-30.683 (27.829)
Log cash compensation	<b>1.186</b> (0.240)	4.543 (2.178)	1.833 (1.083)	2.943 (2.008)
Form	0.002 (0.003)	-0.017 (0.031)	-0.026 (0.015)	-0.033 (0.028)
D1	-0.086 (0.430)	4.434 (3.890)	5.817 (1.934)	-3.265 (3.588)
D2	-0.129 (0.408)	0.540 (3.698)	4.533 (1.839)	0.421 (3.411)
D3	<b>-0.871</b> (0.465)	-1.114 (4.209)	1.904 (2.093)	-7.751 (3.883)
<b>Residual</b>	<b>-0.797</b> (0.322)	-0.231 (2.913)	0.194 (1.448)	1.846 (2.686)
Observations	168	168	168	168
<b>R-squared</b>	0.2102	0.069	0.1058	0.1055
Intercept	-8.968 (2.401)	-28.345 (21.441)	-10.437 (10.674)	-14.550 (19.496)
Log Total compensation	<b>0.739</b> (0.167)	2.685 (1.492)	0.949 (0.743)	<b>1.719</b> (1.356)
Form	<b>0.004</b> (0.003)	-0.009 (0.030)	-0.022 (0.015)	-0.027 (0.027)
D1	-0.236 (0.432)	3.806 (3.854)	5.512 (1.919)	-3.679 (3.504)
D2	-0.279 (0.412)	-0.060 (3.675)	4.269 (1.830)	0.029 (3.342)
D3	<b>-0.972</b> (0.470)	-1.524 (4.200)	1.715 (2.091)	<b>-8.020</b> (3.818)
<b>Residual</b>	<b>-0.430</b> (0.255)	1.467 (2.279)	0.958 (1.134)	<b>3.798</b> (2.072)
Observations	168	168	168	168
<b>R-squared</b>	0.1863	0.0675	0.1019	0.1293

In the case of total compensation, a 1% increase yields a 0.0074\$ increase in earning per share, which represents a 0.6% increase on the mean company's net income.<sup>30</sup> Finally, with NPM, the coefficient is significant only at 20%. A 1% increase in total salary will increase performance by 1.72%, which represents a similar percentage increase for a company's net profit. The coefficient is now smaller, yet it is still a fair indication of the strength that ties wage fluctuation to a company's performance.

With the use of multiple instrumental variables, I use an overidentifying restriction test to check for the presence of endogenous variables in the reduced model.<sup>31</sup> The results are summarized in table 8.

**Table 8**  
**Overidentifying restriction tests**

	EPS	NPM	Critical Value
Log(Cash Compensation)	13.60	n/a	22.36
Log(Total compensation)	18.04	11.96	22.36

Whether I take EPS or NPM, I cannot reject the null hypothesis that all instrumental variables are exogenous against the 5% critical value of  $X^2_{(13)}$ .

#### 5.1.4 Heteroskedasticity

In order to conclude, I still need to check for forms of heteroskedasticity. To test for heteroskedasticity, I will first look at figures 2-9, which are plots of fitted values against their residual that can be found in Appendix C. If I take wide enough boundaries, the plot of each figure seems to exhibit a constant variance. Since it is hard to define if a variance is constant just by looking at a plot graph, I run a Breusch Pagan test to confirm that all the models are in fact homoskedastic. Table 9 summarizes the results of the test for both compensation structures.

Regardless of the compensation structure or the form of performance used, I cannot reject the null hypothesis of homoskedasticity.

<sup>30</sup> With mean net income at \$229,786,570, this represents a \$1,378,719 increase.

<sup>31</sup>  $OT = nR_1^2 \sim X^2_{(13)}$ . Where the R-square is obtained from regressing the residual, gathered in the 2SLS equation, against all the exogenous variables.

**Table 9****Breusch Pagan Heteroskedasticity Test**

	<b>Log (Cash Compensation)</b>	<b>Log (Total Compensation)</b>
<b>EPS</b>	5.880**	6.703**
<b>ROE</b>	8.198	8.803
<b>ROA</b>	6.653	6.367
<b>NPM</b>	6.350	26.074**

Note: The (\*\*) is for results applied against a 1%,  $X^2_{(14)} = 29.14$ . All other results are tested against a 1%,  $X^2_{(5)} = 15.09$

This concludes section 5.1 and partially corroborates past studies results in that the relationship between performance and salary is positive and statistically significant. The results divert from other studies in terms of the size of the coefficient representing the sensitivity level of the relationship. While most researchers have found very low sensitivity levels, I find a wage coefficient that has a strong impact on performance. Depending on the performance measure used, it will vary in size; nevertheless, it remains strong and is a good indication of the benefits obtained through incentive contracts. Switching from cash compensation to total compensation reduces the size of the coefficient and lowers the impact of the variation, which reinforces the initial statement made in section 3.2 concerning the drawbacks of excluding equity compensation when accounting for wage (i.e., results found in the past might have been overestimated). Models used and the period being observed explain the difference with past research. With several scandals involving CEO's made public in recent years, company's have been more transparent with their financial statement accuracy and board of directors have been more reasonable with pay packages offered to chief executives. Finally, the difference in compensation structure barely affected the coefficients for *industry sectors* and the *date of formation*. In all cases, the variables were not consistently significant; hence, they should not always be included in the regressions.

In an attempt to determine if a specific industry exhibits a different level of sensitivity, I focus on subgroup D2 in the following section.

### 5.2.1 Descriptive Statistics on subgroup D2

The industry group D2 consists of 70 companies in the raw material, industrial product and public service sectors. Looking at the mean: ROE dropped by 0.76%, ROA increased by 0.72%, EPS increased by \$0.07, and NPM increased by 2.59%. The average cash compensation decreased by \$39,240, yet the LTIP increased by \$89,662, which means that total salary increased by \$50,422.

**Table 10**  
**Frequency table for the Binary variables (n=70)**

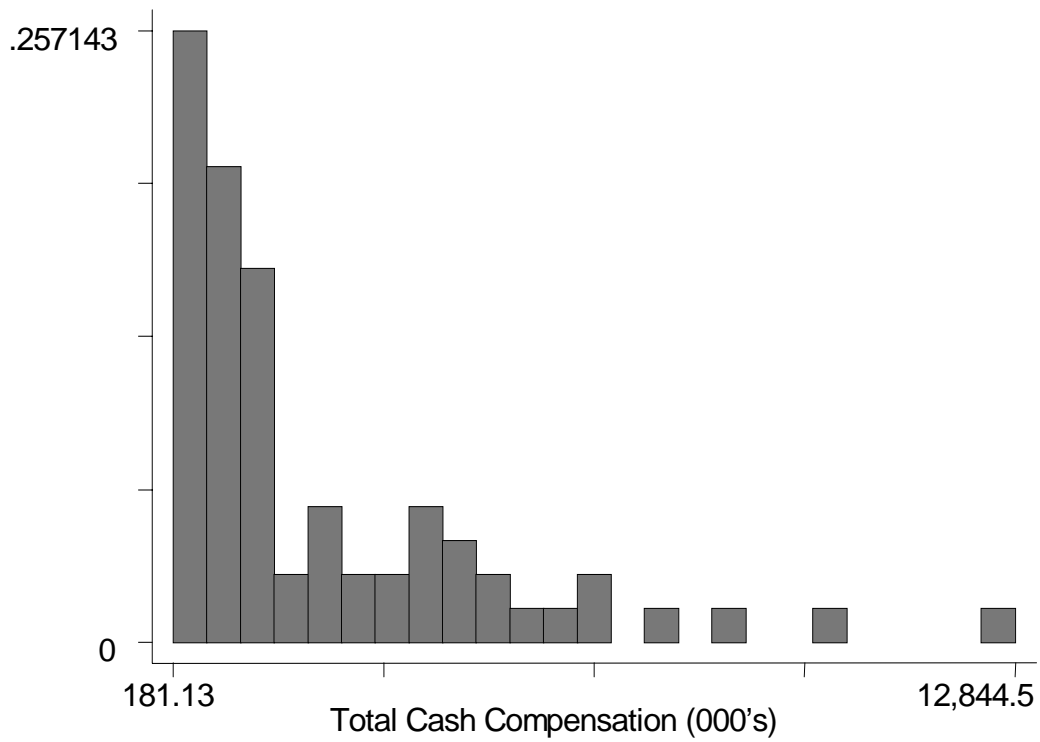
	Number	Percent
<b>Level of Education</b>		
Up to Bachelor	30	43%
1-3 Year post Bachelor	32	46%
4 Year post Bachelor	8	11%
<b>Stock Exchange</b>		
Trading on one	43	61%
Trading on multiple	27	39%
<b>Ownership type</b>		
Owner run	40	57%
Manager Run	30	43%

The age, tenure and education level remains unchanged. While the firms are still quite large, the average annual sales dropped to 2 ½ billion dollars annually. The remaining descriptive statistics (min, max, and standard deviations) are disclosed in tables 10 for binary variables and table 11 for the other exogenous variables.

Figure 18 shows the distribution of total pay for group D2. The bulk of salaries are now concentrated closer to the two hundred thousand dollar point. Total salaries in this subgroup are greater and more spread out. As per with all industry sectors, long term incentive plans still account for 50% of total pay. In addition, while average sales (indicating size) are 850 million dollars smaller, the CEO earns on average \$50,000 more annually. This could be due to the subgroup D2 valuing education at a higher level.

**Table 11**  
**Summary of selected statistics (n=70)**

<b>CEO Variables</b>	<b>Mean</b>	<b>Std Dev</b>	<b>Min</b>	<b>Max</b>
Salary + Bonus + Other (\$000's)	1,198.081	1,038.577	145.530	5,550.000
LTIP (\$000's)	1,163.536	1,956.099	0.000	11,198.750
Total compensation (\$000's)	2,361.617	2,515.154	181.130	12,844.540
Age	53.97143	8.316165	36	85
Tenure	9.014286	11.28099	0	51
% Outside	75.52529	15.64673	28.57	100
Sitting	9.371429	2.751397	5	17
Size (\$000's)	2,440,680	3,176,750	24,653	17,900,000
Date of Formation	29.3	26.00967	4	123
<b>Firm Variables</b>				
EPS	1.335143	1.853307	-1.57	8.09
ROE	9.422714	14.4492	-51.62	52.91
ROA	6.664571	7.113448	-2.85	33.79
NPM	9.069143	14.8791	-17.8	65.1



68% of companies have awarded stock options to their CEO's. The average Call option awarded to a CEO has a value of \$7.57. The Mean options decreased to 166,460 units for an average market value of \$1,244,836. These options have an average maturity of 8.4 years and a mean annual volatility of 29.6%. The maximum value of volatility for a stock went down from 163% to 68%. This is not surprising because this subgroup represents company less variant to outside factors. The remaining descriptive statistics (min, max, and standard deviations) for the other variables used in Merton's model are disclosed in tables 12.

**Table 12**  
**Options Summary statistics (n=48)**

	Mean	Std. Dev	Min	Max
Market Value	24.371	19.568	1.800	108.783
Strike Price	24.262	19.549	1.800	108.783
Maturity	8.396	2.151	5.000	11.000
Dividend yield	0.026	0.032	0.000	0.131
Risk free rate	0.046	0.004	0.038	0.053
Volatility	0.298	0.128	0.147	0.682
Number of options (000's)	166.460	206.774	4.000	1,000.000
Call option	7.574	7.515	0.000	43.324
Value of option (000's)	1,244.836	2,075.494	16.150	11,200.000

Looking at the correlation matrix of compensation and other control variables in table 13, the size of the company and executive wage are still correlated at a high level. The correlation between salary and percentage of directors sitting on the board dropped by 20%; hence, subgroup D2 salary scale is influenced less by the boards composition. While some variables are still strongly correlated, there is no sign of multicollinearity.

**Table 13**  
**Correlation Matrix (Compensation, other control variables)**

	lsalbon	ltotcomp	age	tenure	outside	sitting	size	form
<b>Lsalbon</b>	1							
<b>Ltotcomp</b>	0.8438	1						
<b>Age</b>	0.053	0.0096	1					
<b>Tenure</b>	0.0098	-0.0941	<b>0.5739</b>	1				
<b>outside</b>	0.2084	0.2738	0.076	-0.1859	1			
<b>sitting</b>	<b>0.3641</b>	<b>0.3932</b>	0.1373	-0.002	0.3251	1		
<b>Size</b>	0.5943	0.6525	0.1409	-0.1769	0.2396	<b>0.5844</b>	1	
<b>Form</b>	0.1447	0.1477	0.2999	0.0585	-0.0561	0.2485	0.2756	1



### 5.2.2 Results on subgroup D2

Once more, ordinary least square regression was used to test  $H_0(a)$ . The results of the regression are displayed in Table 14.

**Table 14**  
**Cross Sectional Regression on D2**

	Model (11) <b>EPS</b>	Model (12) <b>ROE</b>	Model (13) <b>ROA</b>	Model (14) <b>NPM</b>
Intercept	-7.668 (3.741)	-30.932 (29.959)	-11.633 (14.564)	-28.344 (30.186)
Log cash compensation	<b>0.659</b> (0.275)	<b>3.028</b> (2.201)	<b>1.448</b> (1.070)	<b>3.021</b> (2.218)
Form	0.000 (0.008)	-0.037 (0.068)	<b>-0.052</b> (0.033)	<b>-0.135</b> (0.068)
Observations	70	70	70	70
<b>R-squared</b>	0.080	0.029	0.053	0.071
Intercept	-5.350 (3.072)	-30.353 (24.264)	-11.404 (11.797)	-30.108 (24.391)
Log Total compensation	<b>0.472</b> (0.218)	<b>2.888</b> (1.722)	<b>1.384</b> (0.837)	<b>3.049</b> (1.731)
Form	0.000 (0.009)	-0.040 (0.067)	<b>-0.053</b> (0.033)	<b>-0.139</b> (0.068)
Observations	70	70	70	70
<b>R-squared</b>	0.067	0.042	0.066	0.087

I begin by analyzing model (11). Cash compensation and total compensation are both significant at 5% with a positive relationship between pay and performance. The coefficients are now smaller and become significant at a higher level. In the case of cash compensation, an increase of 1% in wage will increase EPS by 0.0065\$. This represents an increase of 0.4% for the subgroups average company's net earnings. As for total compensation, an increase of 1% in salary will increase EPS by 0.0047\$, which is a 0.3% increase on the average company's net income.<sup>32</sup> In both cases, I reject the null  $H_0(a)$ , and find that there is a correlation between compensation and performance. The sensitivity level dropped for both compensation structure when compared to the sample as a whole, but the coefficient is strong enough not to be considered marginal. The

<sup>32</sup> The mean company net income is \$228,321,060. A 0.3% increase represents a hike of \$684,963 in net earnings.

variable *form*, when looking at both compensation structures, is statistically insignificant and exhibits very high p-values.

Model (12) replicates the regression but with ROE as the performance measure. Using first cash compensation, I reject the null  $H_0(a)$  at 20%. A 1% increase in cash compensation increases ROE by 3.02%, which yields a 3.02% increase on a company's net income. Using total compensation, I reject the null at 10%. When total compensation increases by 1%, ROE increases by 2.88%; hence, a firm's net earnings would also increase by 2.88%.<sup>33</sup> As per with the previous section, the elasticity model displays clearer and stronger effects of wage fluctuation on performance. The sensitivity levels dropped for both types of compensation structure. In the case of cash compensation they dropped by close to 1% and by 0.5% for total compensation. While it appears that the CEO's from this subgroup are not as responsive to wage increases, one should not forget that the company's forming this subgroup might be limited by the growth potential of their industry. As an example, a CEO in the financial sector might be able to develop certain strategies that would permit capital growth more so than a CEO in the raw material sector. In addition, the variable *form* is not statistically significant.

Model (13) replicates the regression but with ROA as the performance measure. The coefficient for cash compensation and total compensation is positive and significant at 20% and 10% for the later; hence, I reject the null  $H_0(a)$  in both case. When cash compensation increases by 1%, ROA increases by 1.44%, which represents a similar percentage increase in net income. When total compensation increases by 1%, ROA increases by 1.38%, which represents a 1.38% increase in net earnings.<sup>34</sup> As per with the other performance measures, the coefficients dropped in size. The variable *form* is significant at 10%. If you look at both remuneration structures, increasing the date of formation by 1 year will decrease ROA by 5% (i.e., net earnings drop by 5%). Compared to the sample as a whole, the size of the coefficient increased by 3% and the relationship is now negative. D2 is a subgroup composed of sectors that should be flourishing when the resources deplete due to an increase in demand; hence, a drop in performance when

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<sup>33</sup> Assuming a company has net earnings of \$300,000,000, this represents a \$8,640,000 increase.

<sup>34</sup> Assuming a company has net earnings of \$300,000,000, this represents a \$4,140,000 increase.

an industry has been in the market for a longer period does not have a straightforward interpretation.

Finally, Model (14) replicates the regression but with NPM as the performance measure. The coefficient for cash compensation and total compensation are positive and significant at 20% and 10% for the later; therefore, I reject the null hypothesis  $H_0(a)$  in both cases. When cash compensation increases by 1%, NPM increases by 3.02%, which represents a 3.02% increase for a company's net profit. When total compensation increases by 1%, NPM increases by 3.04%, which yields a similar percentage increase for a firm's net profit.<sup>35</sup> The variable *form* is now statistically significant at 5%. When looking at both payment structures, increasing the date of formation by 1 year will decrease NPM by 13%, which is substantial and counterintuitive.

The results are consistent with the ones obtained in section 5.1. While there is a positive statistical relationship connecting pay to performance, the magnitude of the relationship is now smaller. The difference in sensitivity varies between 0.1 to 1% depending on the type of remuneration and performance measure being used. As per with the previous section, the sensitivity is smaller when using total compensation. In addition, the R-square went down for all performance measures in this subgroup, but this could be due to a smaller degree of freedom and a smaller sample size.

### 5.2.3 Endogeneity

I run a regression with robust standard error on equation (2) to test if the instrumental variables are still strong and jointly significant. Table 15 summarizes the results.

As per section 5.1, I only analyze data for total compensation since it holds more relevance in the context of my research. When looking at subgroup D2, larger amounts of variable are individually statistically significant. The coefficient for *age* is negative and significant at 15%. A 1-year increase in the CEO's age will decrease his total pay by 2%. On the other hand, a 1-year increase in *tenure* will increase CEO salary by 2%. The dummy variables for *education* are significant at 15%. If the CEO has an education level that is either at *Educ2* or *Educ3* level, his wage will be greater by either 30% or 53% for

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<sup>35</sup> Assuming a company has net profits of \$50,000,000, this represents an increase of \$1,520,000.

the later, which supports the earlier made statements on the subgroup valuing education at a higher level. If the company is trading on more than one stock exchange, the CEO's earn 52% more on his wage. If the CEO runs the company, his salary is 39% higher.

**Table 15**

**Regression with Robust Standard Errors**

	Model (15) <b>Log(Cash Compensation)</b>	Model (16) <b>Log(Total Compensation)</b>
Intercept	6.309 (1.576)	5.819 (1.809)
Form	0.001 (0.002)	0.003 (0.003)
Age	<b>-0.017</b> (0.015)	<b>-0.024</b> (0.016)
Tenure	<b>0.025</b> (0.020)	<b>0.024</b> (0.025)
Tenure2	0.000 (0.000)	0.000 (0.000)
Educ2	0.175 (0.176)	<b>0.269</b> (0.192)
Educ3	<b>0.536</b> (0.259)	<b>0.428</b> (0.297)
Outside	0.003 (0.008)	0.003 (0.008)
Sitting	-0.008 (0.040)	-0.018 (0.051)
SE2	0.071 (0.197)	<b>0.421</b> (0.269)
RUN2	0.113 (0.163)	<b>0.327</b> (0.196)
Size	<b>0.370</b> (0.085)	<b>0.423</b> (0.095)
Observations	70.000	70.000
R-square	<b>0.451</b>	<b>0.564</b>

Finally, the size of the company is still positive and statistically significant at below 1%. A 1% increase in *size* will increase total wage by 0.42%, which is a marginal increase.

The instrumental variables for both models (15) and (16) are still very strong with R-squares at 45% and 56%. I reject the null hypothesis of *not jointly significant* for both compensation structures. Model (15) has an f-statistic of 4.54 and model (16) has an f-

statistic of 7.20. While both f-statistics are significant, they are low compared to ones estimated in section 5.1.3.

I proceed to collect the residuals for both models and run OLS regressions on equation (3). Table 16 summarizes the results.

**Table 16**  
**OLS Regression with residuals on D2**

	Model (7) <b>EPS</b>	Model (8) <b>ROE</b>	Model (9) <b>ROA</b>	Model (10) <b>NPM</b>
Intercept	-12.071 (5.630)	-48.345 (45.372)	-24.736 (21.995)	-23.917 (45.802)
Log cash compensation	<b>0.983</b> (0.415)	4.312 (3.341)	2.414 (1.620)	2.695 (3.373)
Form	-0.002 (0.009)	-0.043 (0.069)	-0.056 (0.033)	-0.133 (0.070)
<b>Residual</b>	<b>-0.579</b> (0.553)	-2.289 (4.460)	-1.723 (2.162)	0.582 (4.503)
Observations	70.000	70.000	70.000	70.000
<b>R-squared</b>	0.095	0.033	0.063	0.071
Intercept	-8.689 (4.102)	-37.784 (32.737)	-15.960 (15.908)	-13.022 (32.786)
Log Total compensation	<b>0.710</b> (0.292)	3.418 (2.329)	1.709 (1.132)	1.830 (2.332)
Form	-0.002 (0.009)	-0.043 (0.068)	-0.055 (0.033)	-0.132 (0.068)
<b>Residual</b>	<b>-0.534</b> (0.437)	-1.189 (3.486)	-0.729 (1.694)	2.733 (3.491)
Observations	70.000	70.000	70.000	70.000
<b>R-squared</b>	0.087	0.044	0.068	0.096

Results from Table 16 are different than ones in table 7. With performance measured by ROE, ROA or NPM, I fail to reject the null hypothesis that salary, regardless of the remuneration type, is an exogenous variable. Therefore, results estimated by OLS are robust and consistent. For EPS, the null hypothesis of exogenous can only be rejected at high levels (i.e., 30% for cash compensation and 25% for total compensation).

While the wage appears to be exogenous with all performance measures, I will assume endogeneity in the case of EPS, and proceed to run a two stage least square on equation (4). Table 16 summarizes the results.<sup>36</sup>

The first thing that becomes obvious is the size of the coefficients increased. Both compensation structures are positive and significant at 5%. A 1% increase in cash compensation now increases EPS by 0.0098\$, which represents an increase of 0.7% on the average company's net income. In the case of total compensation, a 1% increase yields a 0.0071\$ increase in earnings per share, which represents a 0.5% increase on the average firms net earnings.<sup>37</sup> The impact of both coefficients on performance increased. In addition, the variable *form* is now statistically insignificant at very high levels.

I use an overidentifying restriction test to check for the presence of endogenous instrumental variables.<sup>38</sup> The results are summarized in table 17.

**Table 17**  
**Overidentifying Restriction Test**

	EPS	Critical Value
Log(Cash Compensation)	11.96	18.31
Log(Total compensation)	11.47	18.31

Regardless of the compensation structure, I cannot reject the null hypothesis that all instrumental variables are exogenous against the 5% critical value of  $X^2_{(10)}$ .

#### 5.2.4 Heteroskedasticity

Before concluding this section, I still need to test for possible forms of heteroskedasticity. I first look at figure 11-18, which can be found in Appendix D. The graph for EPS fitted values against residuals, seems to exhibit an increasing variance for both types of compensation structures. The graph for ROE, ROA and NPM is a bit more erratic with the residuals being fairly dispersed. If I take wide boundaries, I can assume

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<sup>36</sup> As indicated earlier, the coefficient estimated are the same as the ones listed in Table 16.

<sup>37</sup> With a mean net income at \$228,321,060, this represents a \$1,141,605.

<sup>38</sup>  $OT = nR_1^2 \sim X^2_{(10)}$ . Where the R-square is obtained from regressing the residual, gathered in the 2SLS equation, against all the exogenous variables.

the variance is constant. To confirm the homoskedasticity of all models, I run a Breusch Pagan test. Table 18 summarizes the results.

**Table 18**

**Breusch Pagan Heteroskedasticity Test**

	<b>Log (Cash Compensation)</b>	<b>Log (Total Compensation)</b>
<b>EPS</b>	6.734**	7.518**
<b>ROE</b>	2.716	2.653
<b>ROA</b>	2.331	2.702
<b>NPM</b>	2.121	2.114

Note: The (\*\*) is for results applied against a 1%,  $X^2_{(11)} = 24.72$ . All other results are tested against a 1%,  $X^2_{(2)} = 9.21$

Regardless of the compensation structure or the form of performance used as an endogenous, I cannot reject the null hypothesis of homoskedasticity.

Results from this section indicate that for subgroup D2 there is a loss of sensitivity between pay and performance. While the size is greater with some of the endogenous variables, it is not significant enough to indicate that this subgroup is less responsive to incentive contract.

## **6 Conclusion**

### **6.1 Summary**

This study provides empirical evidence that there is a positive correlation between performance and CEO compensation for Canadian publicly traded companies. The evidence is consistent with studies done in the United States, yet it separates itself in terms of the strength of the sensitivity level that defines this relationship. While most researchers have agreed that there is a positive relationship connecting a chief executive's salary to a firm's performance, their results always yielded weak sensitivity levels indicative of marginal response when varying salary to improve a company's performance. This severely questioned the efficiency of incentive contracts and further emphasized the possible disparity of the situation.

In this paper, performance as measured by earning per share is positively correlated to short and long term monetary remuneration. It is statistically significant below 1%, and for every 1% increase on a chief executive total compensation, it represents a 0.6% increase on the average company's net earning. The use of other performance measures such as ROE, ROA and NPM yielded similar relationships, but with coefficients indicating a stronger impact of wage variation on net earnings or net profits. In the case of ROE and ROA, the variation of a company's net income went as high as 4% for every 1% increase on total CEO's remuneration. This effect is by far superior than the common shareholder would have anticipated and ties perfectly with the period being observed. This is not a period of bullish market anymore, and with shareholder confidence being eroded steadily every time a new company scandal surfaces, firm's necessity for transparency has made incentive contracts as efficient as possible.

In an attempt to test whether this relationship might be different when focusing on a specific industry sector, I ran similar tests on a subgroup of the sample. The subgroup was composed of three major sectors: raw material, industrial product, and public service industry. The relationship between performance and compensation remained positive. The coefficients became significant at higher levels, and their size dropped by close to 1%. The sensitivity levels are far from being negligible but indicate a lower performance response when increases in salary occur. This shows that companies from these specific



industry sectors might not be able to increase their performance as easily even if the CEO leading them is working in the best interest of the firm.

This study also pointed out that when excluding long-term incentive plans from the remuneration structure of a CEO, all results become overstated. This held true whether I focused on the sample as a whole or just a subgroup of its sectors. The hypothesis of possible endogeneity of wage was confirmed when tested against earning per share and net profit margin. With the endogeneity of pay, came the use of instrumental variables. The choice of instrumental variables (i.e., age, tenure, tenure-square, board composition, ownership type, stock exchange, and size of company) was guided by past research on CEO determinants. The instrumental variables used were strong with R-squares ranging between 50 to 60% and were jointly significant with strong f-statistics. The coefficients estimated by 2SLS were positive, statistically significant at 5%, and were greater in size than the ones estimated by OLS. When focusing on the subgroup, the hypothesis of endogeneity of wage surfaced in the model with EPS but only at 30% level. As per results from the total sample, the relationship kept the same properties found in the total sample.

This study has taken a different approach to past studies by analyzing the problem as an effect of wage fluctuation on performance. The results were robust regardless of compensation structure or performance measures. The sensitivity tying pay to performance remained strong. An attempt to test whether a subgroup of industry would change the type of relationship, proved accurate. The subgroup encompassing raw material, industrial product, and public service sector, displayed a lower sensitivity level between salary and performance regardless of the payment structure.

The parallel between chief executive officers remuneration between Canada and the US is not shocking given the economic tie that has developed between Canada and the United States. What becomes clear in this research is that labour contracts attempting to link pay to performance are efficient and appear to be successful in resolving the agency problem. It is my belief that the disparity of sensitivity found between my research and past research are not strictly due to my model but to the period being observed. These findings shed new light on this question and should motivate any future

research to focus on the period at hand instead of looking at 10 year-old data to define the pay performance relationship.

## **6.2 Suggestion for future research**

While the conclusions of this paper are robust, here are suggestions for future research in the area of firm's performance and chief executive officer compensation.

If one were to have access to greater resources, a larger sample size could be gathered and the use of panel data can be considered. The use of panel data can give the researcher greater options when defining performance measures. Murphy's use of a variation in shareholder wealth has merits and should be considered. When performance is measured in different ways, more robust results can be obtained and clearer interpretation of results can be given. With a larger sample size, a distinction could be placed between smaller and larger firms to see if the sensitivity levels are affected differently. A larger sample size, may also give the opportunity to focus solely on a single sector and test for changes in sensitivity levels.

In this study Merton's modified Black Scholes formula is used to value the option portion of the LTIP. When looking at long periods of maturity, assuming constant volatility is not precise. If a model were to account for fluctuating volatility over the maturity period of the option, a more accurate valuation of options could be rendered. These new values may modify the relationship tying pay to performance since they form the nucleus of incentive contracts.

Finally, if one were to have greater access to companies accounting information, it would be interesting to further delve into the firms consolidated statement of earnings. While I have used different performance measures to clarify the interpretation of the sensitivity levels, it would be interesting to see what portion of operating expenses a CEO salary represents. This could give further insight on the size of the impact caused by a CEO's salary increase and therefore give a better idea of the resulting proportional size of the variation in the earning portion.

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Yahoo Finance, <http://ca.finance.yahoo.com>

CNN money, <http://money.cnn.com>

## Appendix A: Option Valuation

### Black-Scholes (1973) model

The Model:

$$C = SN(d_1) - Ke^{(-rt)}N(d_2)$$

C = Theoretical call premium

S = Current Stock price

t = time until option expiration

K = option striking price

r = risk - free interest rate

N = Cumulative standard normal distribution

e = exponential term(2.7183)

$$d_1 = \frac{\ln(S/K) + \left(r + \frac{s^2}{2}\right)t}{s\sqrt{t}}$$

$$d_2 = d_1 - s\sqrt{t}$$

s = standard deviation of stock returns

ln = natural logarithm

The first part, SN(d1), derives the expected benefit from acquiring a stock outright. The second part of the model, Ke(-rt)N(d2), gives the present value of paying the exercise price on the expiration day. The market value of the call option is then calculated by taking the difference between these two parts. (Rubash, Kuvlin. Bradley University)

### Merton's modified Black-Scholes (1973)

$$C = Se^{-dT}\phi(Z) - Xe^{-rT}\phi\left(Z - \sigma\sqrt{T}\right)$$

Where:

C = Price of option

S = Common stock price on the date of grant (data source: proxy statement)

X = Strike price (data source: proxy statement)

$\phi(\cdot)$  = Cumulative standard normal distribution function

T = time to expiration (data source: proxy statement)

r = continuous risk-free interest rate, measure as  $\ln(1+R)$ , where R is the annual 2, 5, 10 and average market yield (data source: Bank of Canada)

- d= continuous dividend yield defined as  $\ln [1 + (\text{dividend per share/closing stock price})]$  (data source: Financial post database)
- $\sigma =$  estimated monthly stock return variance for a period of 24 months. (data source: Yahoo finance historical stock price)
- Z= 
$$\left[ \ln(S / X) + \left( r - d + \frac{\sigma^2}{2} \right) \right] \left( \frac{T}{\sigma \sqrt{T}} \right)$$



## **Appendix B: Sample Firms**

George Weston limited  
Royal Bank of Canada  
BCE Inc.  
Canadian Imperial bank of commerce  
Power Corporation Canada  
Encana Corporation  
Bank of Montreal  
Quebecor Inc.  
Sobeys inc.  
Hudson's Bay Company  
Canadian Tire Corporation, Limited  
Suncor Energy inc.  
Nova Chemicals Corp  
Abitibi-Consolidated Inc.  
Enbridge inc.  
Domtar inc.  
Cp Ships Limited  
Inco Limited  
Cascades Inc.  
Agrium Inc.  
Industrial Alliance Insurance  
and Financial Services inc.  
Tembec inc.  
Barrick Gold Corporation  
CGI Group Inc.  
Placer Dome Inc.  
Masonite International  
Ati Technologies Inc.  
Cott Corporation  
IPSCO Inc.  
Intrawest Corporation  
Linamar Corporation  
Penn West Petroleum Limited  
Emera Inc.  
Laurentian Bank of Canada  
Cinram International inc.  
Canadian Oil sands trust  
Forzani Group Ltd.  
Creo Inc.  
Canam Group Inc.  
Manitoba Telecom Services Inc.  
Transforce income fund  
Cossette communication Group Inc.  
Flint energy services limited  
Geac Computer Corporation Limited

Loblaw Companies limited  
Sun Life Financial Inc.  
Imperial Oil Limited  
Manulife Financial Corporation  
Toronto Dominion Bank  
Nortel Networks Corporation  
Petro-Canada  
Thomson  
Shell Canada Limited  
Telus Corp.  
Noranda Inc.  
Canadian national Railway Company  
Transcanada Corporation  
Talisman energy inc.  
Rogers Communication inc.  
National Bank of Canada  
Canadien Pacific Railway Limited  
Dofasco inc.  
Nexen inc.  
Saputo Inc.

SNC-Lavalin Group Inc.  
Falconbridge Limited  
Agricore United  
Rona Inc.  
TransAlta Corporation  
Aliant Inc.  
Methanex Corporation  
Precision Drilling Corporation  
MDS inc.  
West Fraser Timber C. ltd.  
Russel Metals Inc.  
Toromont Industries limited  
Algoma Steel Inc.  
Biovail Corporation  
CAE Inc.  
Fording Canadian Coal Trust  
Reitmans (Canada) Limited  
Fortis inc.  
Kinross Gold Corporation  
FPI limited  
Arc energy trust units  
Ridley Inc.  
Hartco Corporation  
Cogeco Inc.

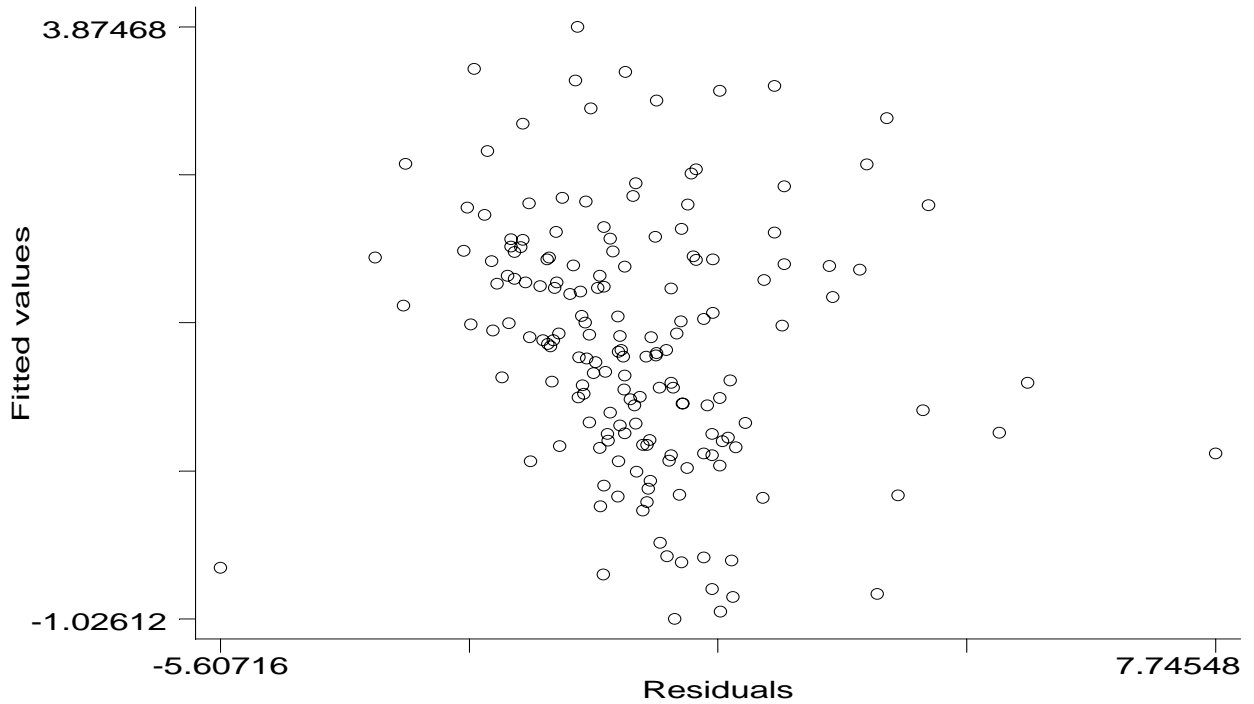
Patheon Inc.  
 Rothmans inc.  
 Softchoice Corp.  
 Astral Media Inc.  
 Bonavista Energy trust  
 Stantec Inc.  
 TimberWest forest Corp.  
 Goldcorp Inc.  
 Hip Interactive Corp.  
 Western Oil Sands Inc.  
 Vermilion energy trust  
 Aur Resources Inc.  
 Contrans Income Fund  
 Trican Well Service Limited  
 Algoma Central Corporation  
 Cambior inc.  
 IPL inc.  
 SportScene Restaurants Inc.  
 NexxLink Technologies Inc.  
 Nurun Inc.  
 Axcan Pharma Inc.  
 Maple Leaf foods inc.  
 Magellan Aerospace Corporation  
 Mullen Transportation  
 SR Telecom inc.  
 Empire Company limited  
 Shaw Communication Inc.  
 Ensign Resources services  
 Samuel Manu-Tech Inc.  
 Baytex Energy trust  
 Strongco Inc.  
 Velan Inc.  
 Potash Corporation of Saskatchewan  
 Trizec Canada  
 Nav Energy Trust  
 Campbell Resources inc.  
 Harris Steel  
 Vitran  
 TVA Group  
 Gendis

ATS automation tooling system Inc.  
 Parkland Income Fund  
 RioCan Real estate investment Trust  
 Leon's Furniture Limited  
 Lions Gate Entertainment Corp.  
 Vincor International Inc.  
 Hub international Ltd.  
 Morguard Corporation  
 Van Houtte Inc.  
 High Liner Foods Incorporated  
 Mega Bloks  
 O&Y Properties Corporation  
 KCP Income Fund  
 Sico Inc.  
 St. Lawrence Cement Group Inc.  
 Shermag Inc.  
 HumptyDumpty Snack Foods  
 Dalsa Corporation  
 EXFO electro-opt engine Inc.  
 Agnico-Eagle Mines Inc.  
 Celestica inc.  
 Canada Bread company, limited  
 Heating oil partner and fund  
 Spectra Premium industry inc.  
 Aeterna Zentaris inc.  
 Metro inc.  
 Finning International Inc.  
 CFM corporation  
 Acetex  
 Dundee Precious Metals  
 Atlas Cold storage Income trust  
 Inmet Mining Corporation  
 Dorel Industries inc.  
 Aecon  
 Research in Motion  
 Goodfellow Inc.  
 Winpak  
 Optimum  
 La Senza  
 SunOpta

## Appendix C: HETEROSKEDASTICITY

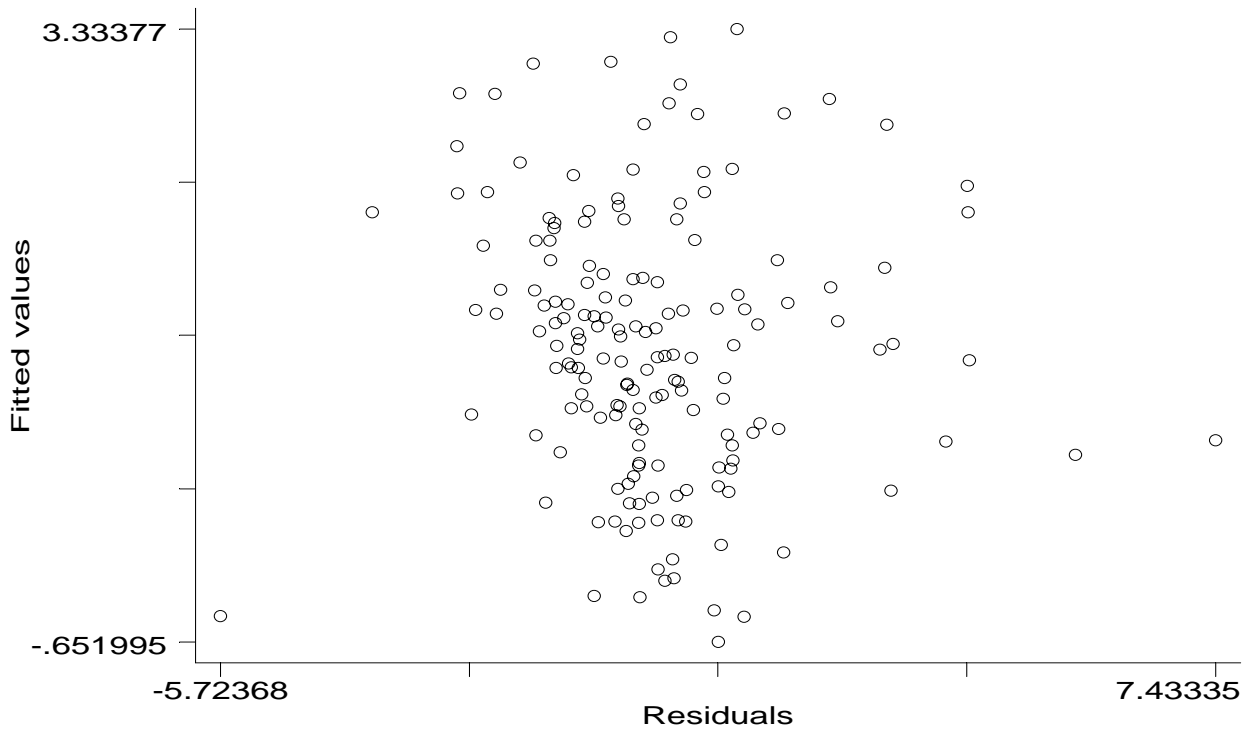
### EPS –[Log (Cash Compensation)]

Figure 2, Graph of fitted values against residuals



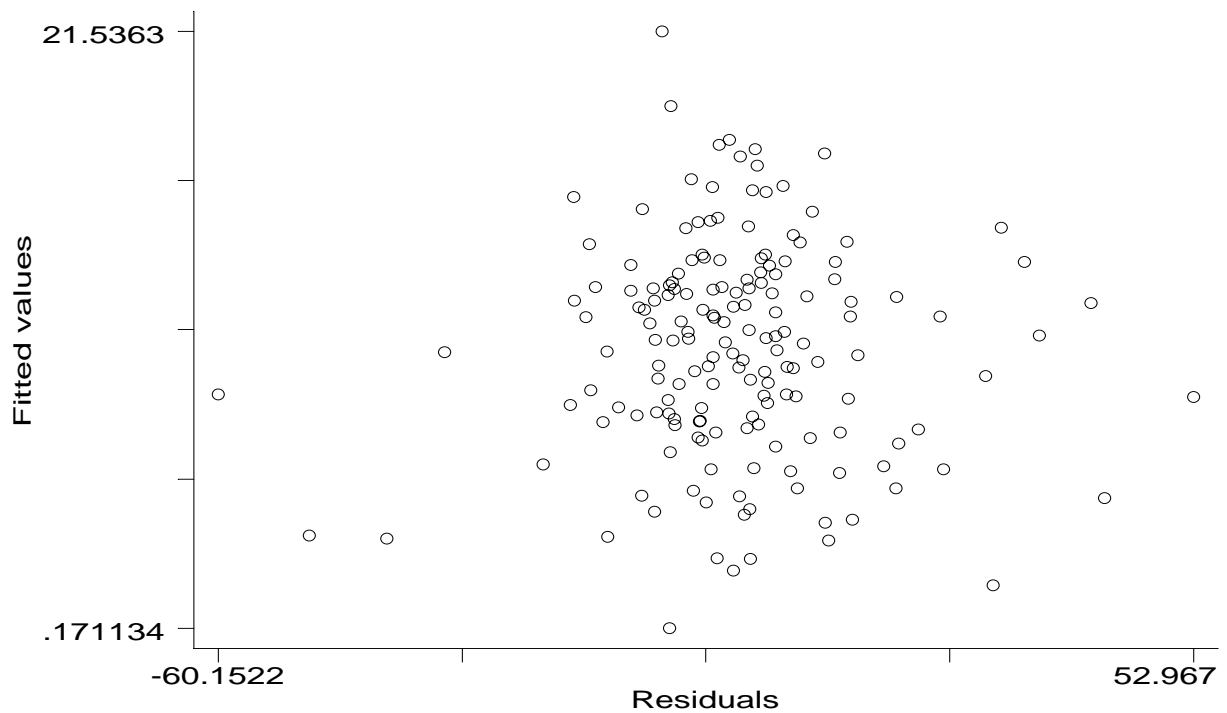
### EPS –[Log (Total Compensation)]

Figure 3, Graph of fitted values against residuals



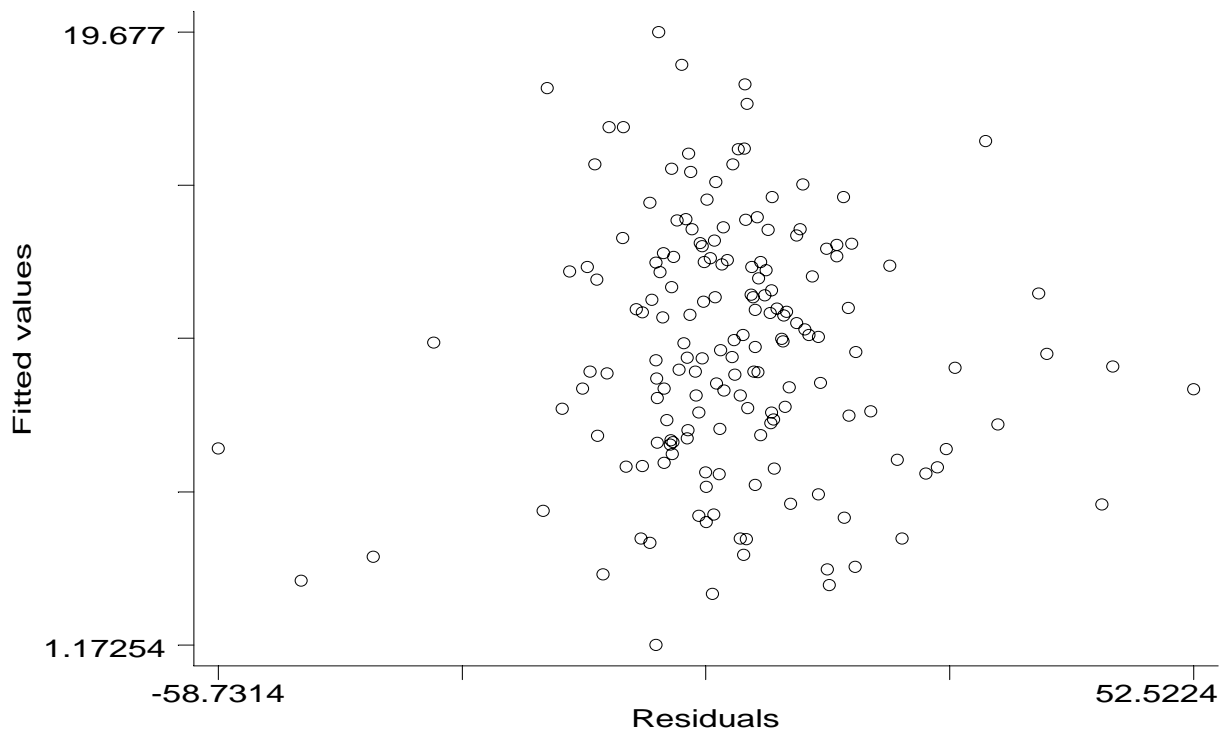
### ROE –[Log (Cash Compensation)]

Figure 4, Graph of fitted values against residuals



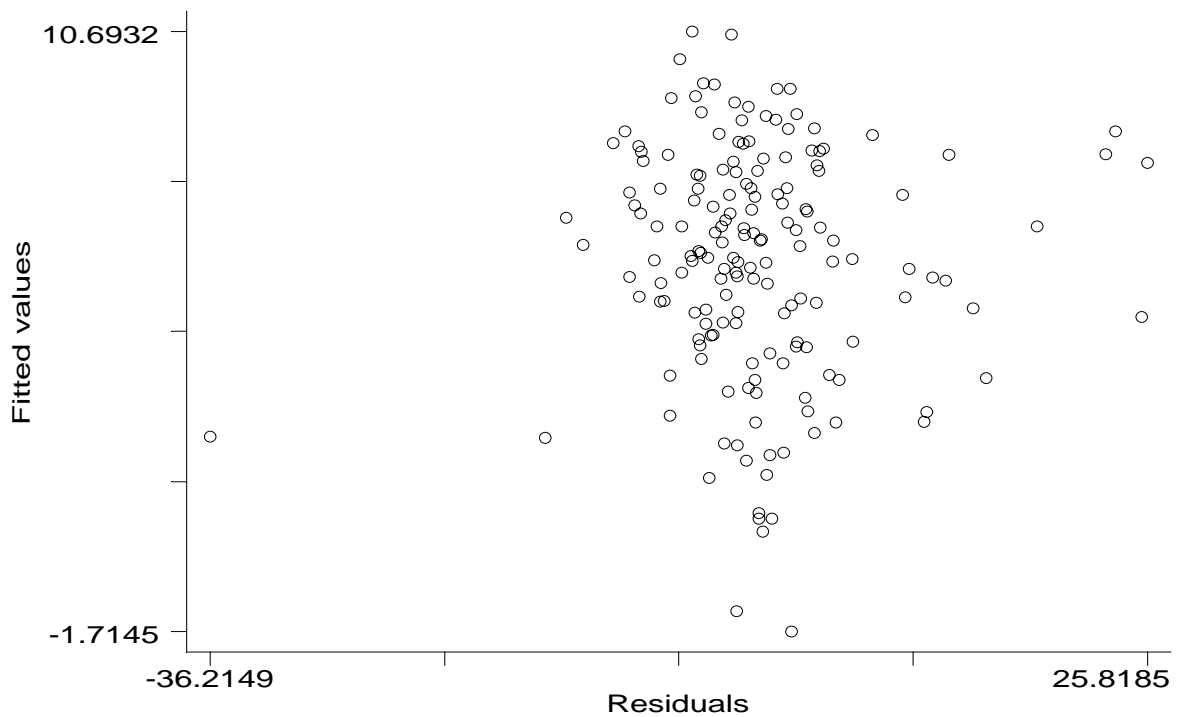
### ROE –[Log (Total Compensation)]

Figure 5, Graph of fitted values against residuals



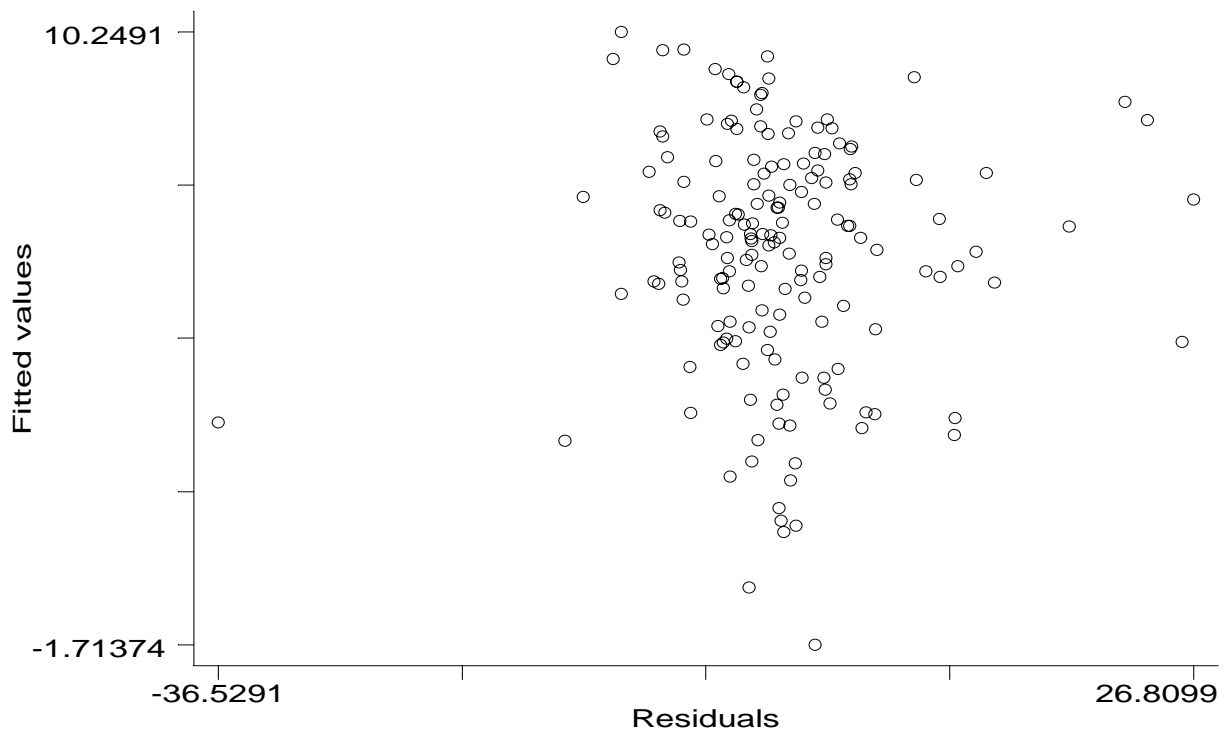
### ROA -[Log (Cash Compensation)]

Figure 6, Graph of fitted values against residuals



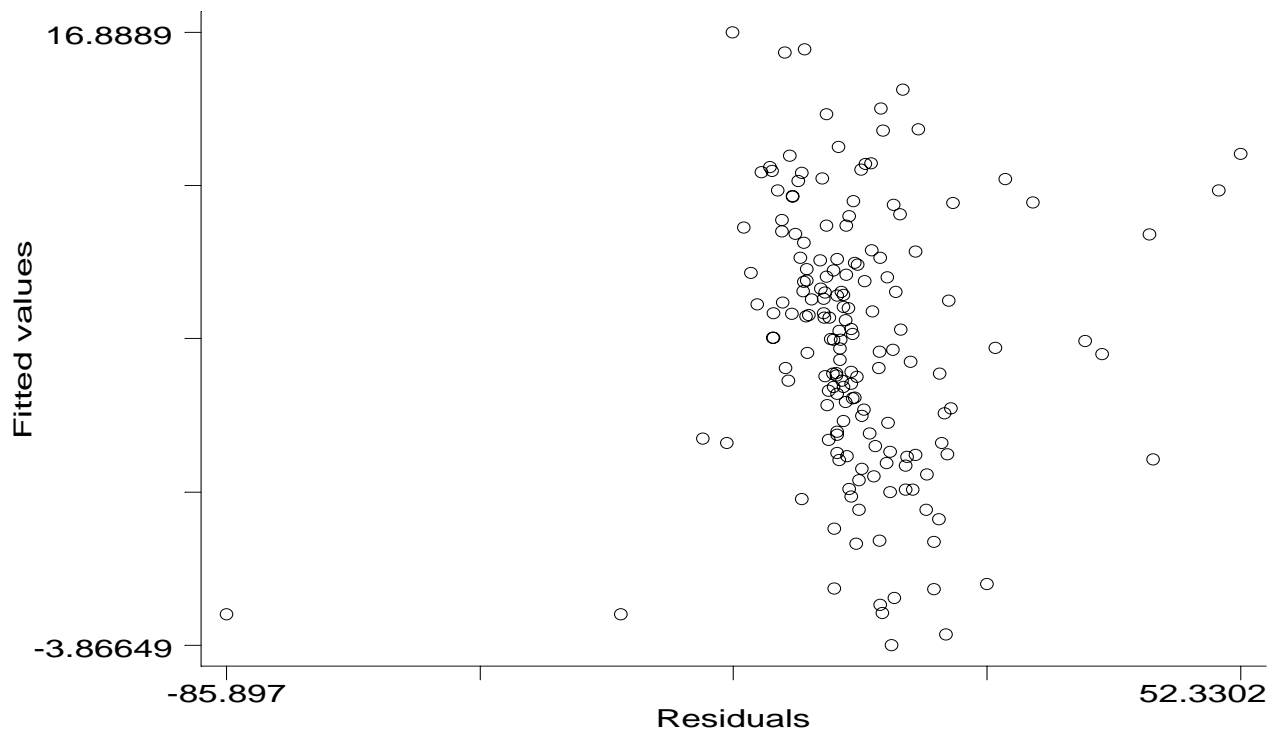
### ROA -[Log (Total Compensation)]

Figure 7, Graph of fitted values against residuals



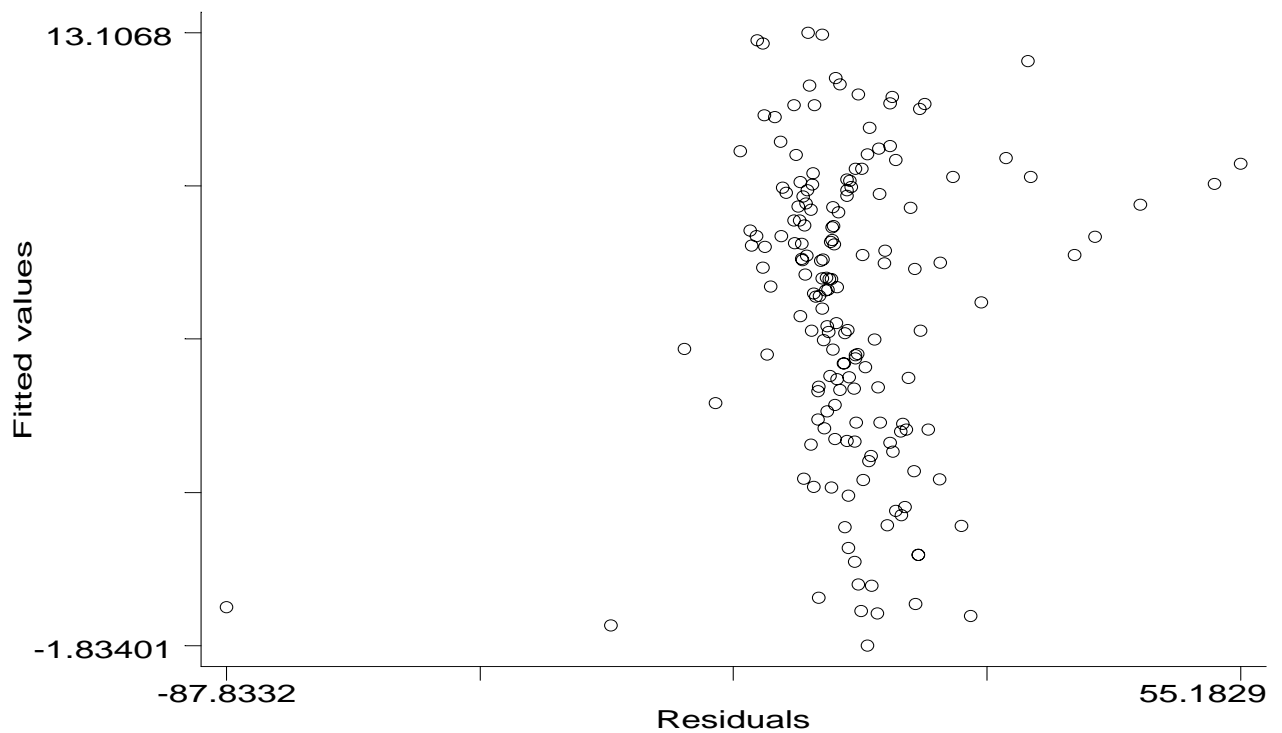
**NPM –[Log (Cash Compensation)]**

Figure 8, Graph of fitted values against residuals



**NPM –[Log (Total Compensation)]**

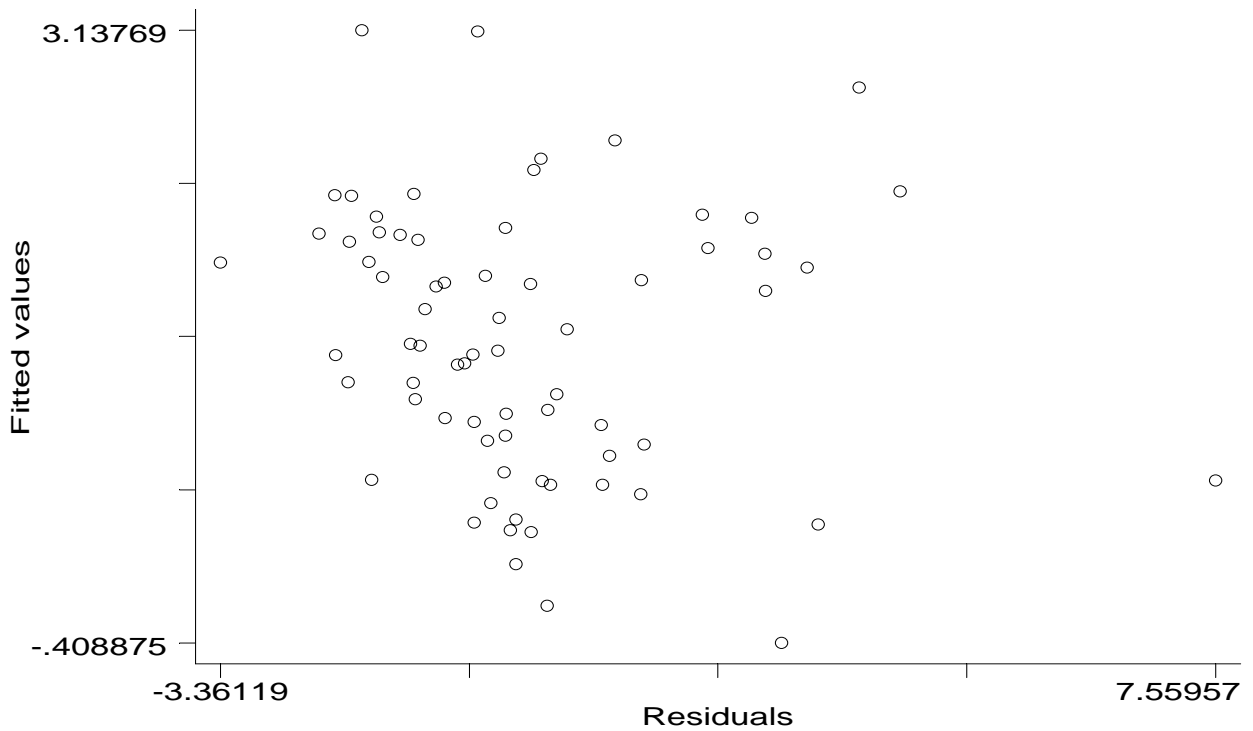
Figure 9, Graph of fitted values against residuals



Appendix D: HETEROSKEDASTICITY on D2

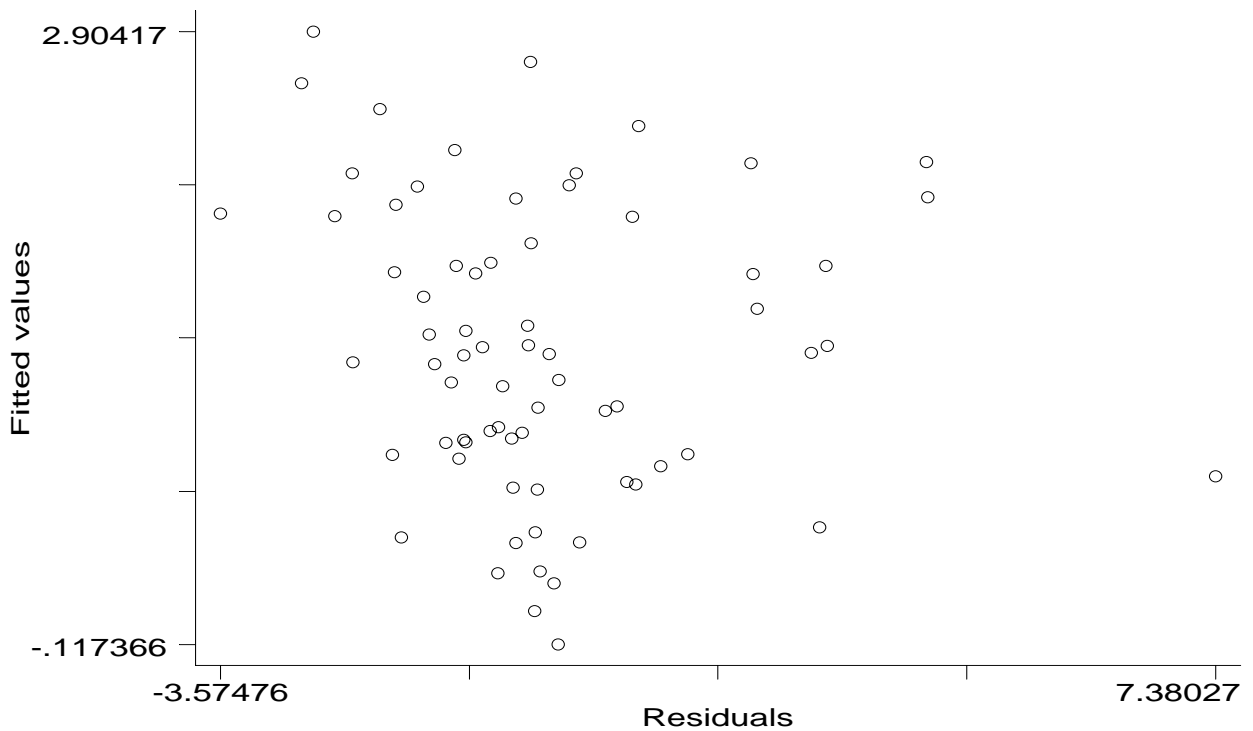
**EPS –[Log (Cash Compensation)]**

Figure 11, Graph of fitted values against residuals



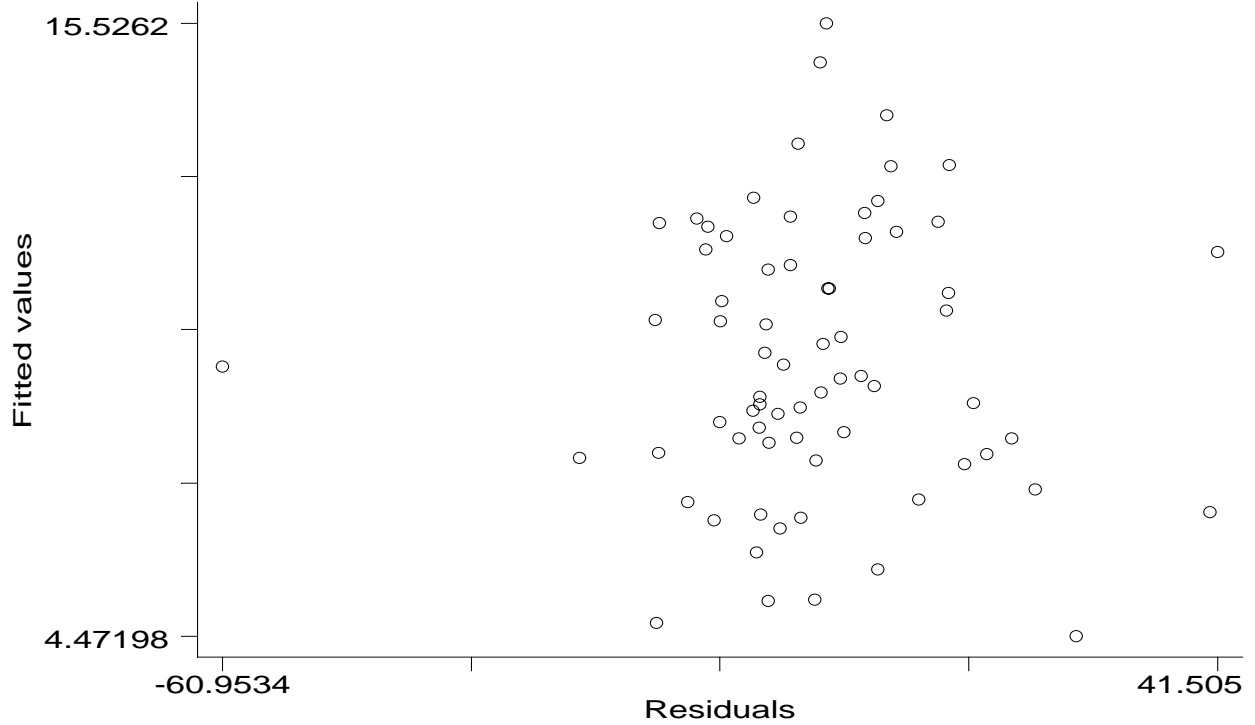
**EPS –[Log (Total Compensation)]**

Figure 12, Graph of fitted values against residuals



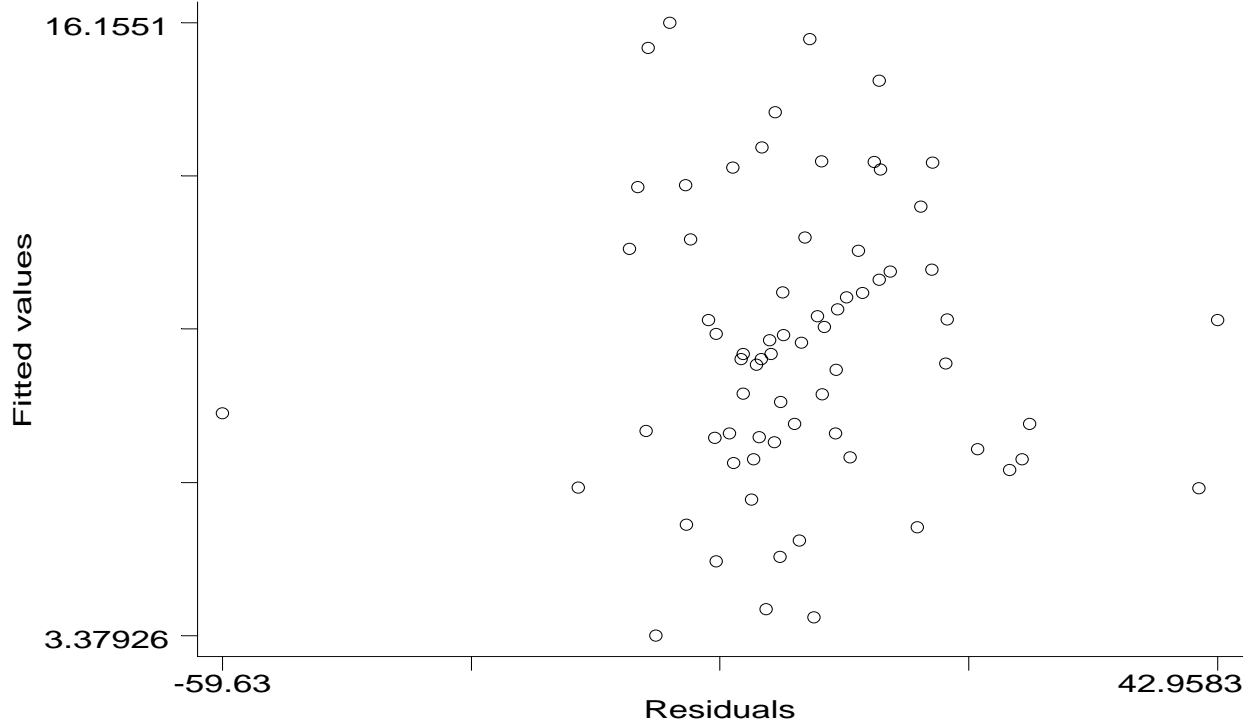
### ROE –[Log (Cash Compensation)]

Figure 13, Graph of fitted values against residuals



### ROE –[Log (Total Compensation)]

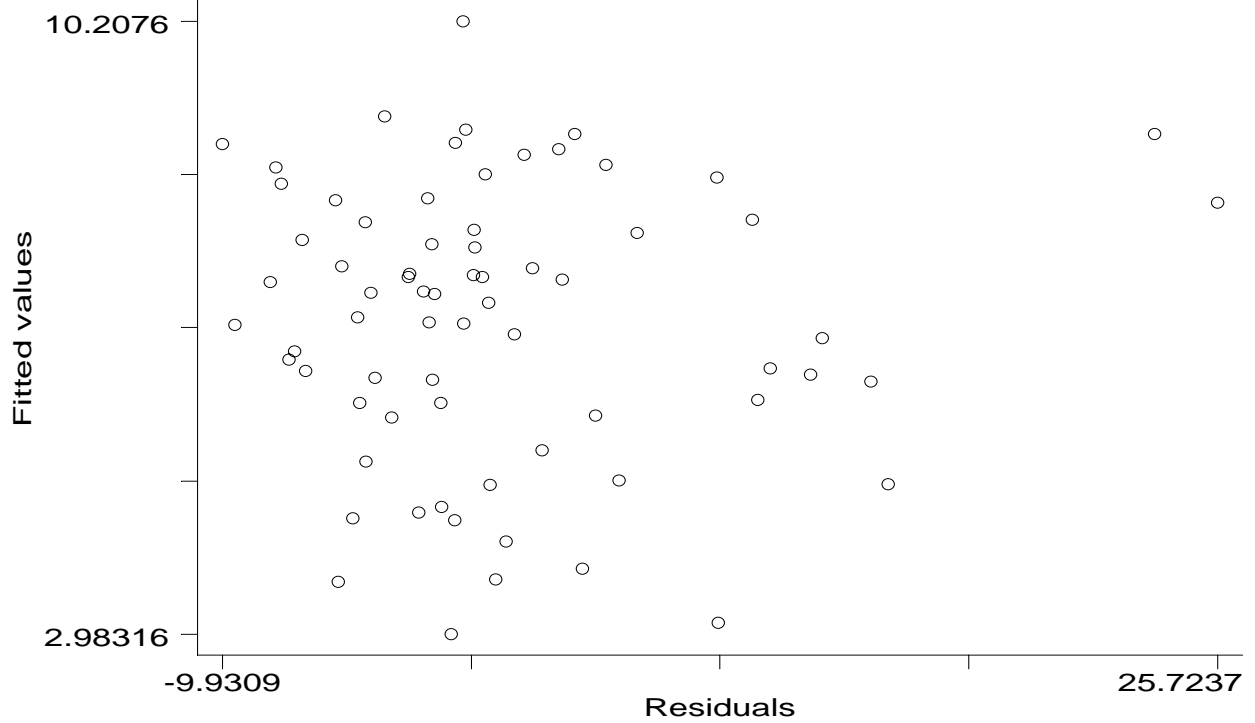
Figure 14, Graph of fitted values against residuals





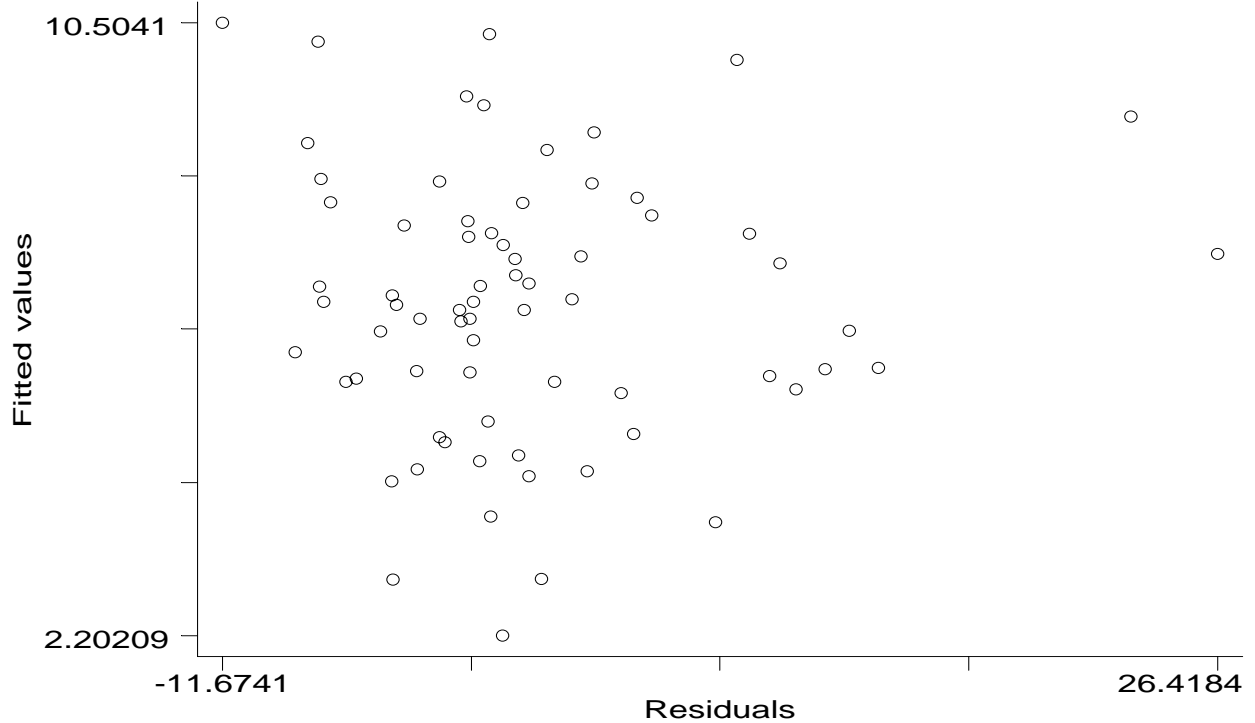
### ROA –[Log (Cash Compensation)]

Figure 15, Graph of fitted values against residuals



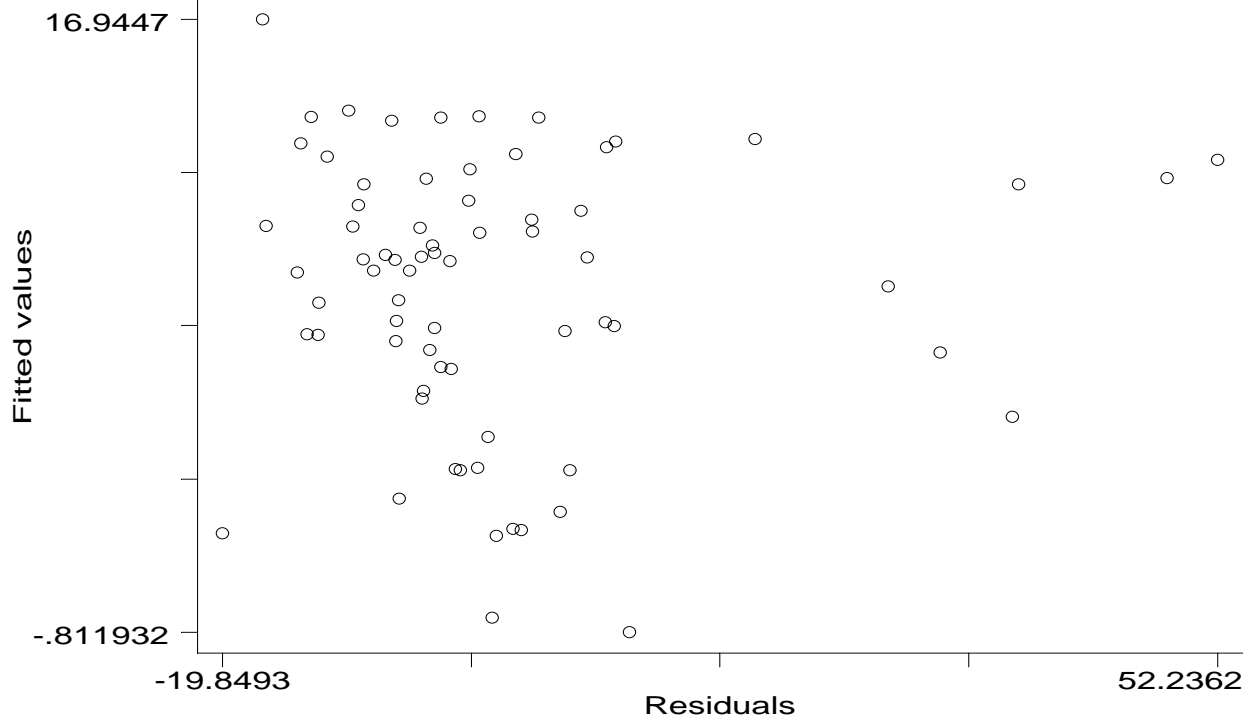
### ROA –[Log (Total Compensation)]

Figure 16, Graph of fitted values against residuals



### NPM –[Log (Cash Compensation)]

Figure 17, Graph of fitted values against residuals



### NPM –[Log (Total Compensation)]

Figure 18, Graph of fitted values against residuals

